REPORT OF

TWENTY-EIGHTH ANNUAL

DATE GROWERS' INSTITUTE

APRIL 28, 1951

HELD IN

COACHELLA VALLEY

CALIFORNIA

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VOLUME 28

CHAIRMAN MORNING SESSION
W. H. Wright

CHAIRMAN AFTERNOON SESSION
J. C. Johnston

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The Date Growers' Institute is the official educational instrument of the date industry. Its goal is the dissemination of information on date growing, handling and marketing. This is its twenty-eighth year. Proceedings of each Institute have been published, and may be purchased in complete sets, or by separate copies. A full Index will be mailed on request. Direct all inquiries to the Secretary.

Donald Everett Bliss

1903-1951

Donald Everett Bliss, Plant Pathologist of the University of California Experiment Station at Riverside, died at San Francisco, California, October 4, 1951. In his untimely death, plant science has lost an energetic and capable young scientist and the University has lost a respected and beloved co-worker. Dr. Bliss had been on the staff of the University for twenty years and had become recognized as an authority on diseases of the date.

Dr. Bliss was born at Greeley, Colorado, May 14, 1903. His public school education was obtained at Greeley. In 1921 he entered the Colorado A and M College at Fort Collins and graduated in 1925 with a Bachelor of Science degree in botany. Continuing his education, he entered Iowa State College in 1926 to take the graduate course in plant pathology. On January 1, 1927, he married Alberta Evelyn Getchell. The same year he received an M. S. degree from Iowa State College. The Ph.D. degree was conferred on him in 1931 for his contribution to the knowledge of cedar-apple rust in Iowa.

Dr. Bliss came to the Citrus Experiment Station as a research assistant in September 1931. His advancement was steady and at the time of his death he held the rank of Plant Pathologist. He was the author or co-author of many scientific articles.

Dr. Bliss had been a member of the Date Growers' Institute since 1932 and attended every annual meeting except in 1951, at which time he was in Florida on sabbatical leave. He was a staunch supporter of the Institute and of its published Annual Reports which comprise one of the principal sources of information on date culture in the world. He believed the Report was a scientific publication and as such he strove to make it one of high standing, readily acceptable by both farmers and scientific workers.

The Reports carry 26 articles written by Dr. Bliss or his co-workers dealing with the culture and diseases of the date palm and its fruit. His contributions were many and included the recognition of two species of the fungus *Omphalia* as a causal factor in the decline of the date palm. His work with others resulted in an explanation of the multiple factors contributing to date-fruit spoilage and the successful and practical combination of covers, rings, and fungicides for the control of that spoilage. The discovery of the order in which leaves were formed on the palm, which in turn afforded an easy method of counting leaves, was a particular satisfaction to him.

In addition to his work on the date and other palms, Dr. Bliss was well known for work with the oak root fungus, *Armillaria mellea*. His last article, published in August 1951, dealt with a significant new principle on the control of the root rot caused by this important fungus.

Dr. Bliss very recently returned from a 6-month sabbatical leave spent at the University of Florida Citrus Experiment Station. While there he worked on a disease of citrus known as spreading decline. In this activity he contributed to the progress being made toward the solution of this difficult problem.

Dr. Bliss was a member of several scientific societies, including the American Phytopathological Society, Mycological Society of America, the American Association for the Advancement of Science, the Society of Sigma Xi, an honorary society, and the Synapsis Club. He also belonged to the Tri-County Club of Southern California, and the Present Day Club of Riverside.

Dr. Bliss entered into many of the cultural activities of his community. He was a member of the Official Board and choir of the First Methodist Church of Riverside. As a member of the Riverside Opera Association, he appeared in many of its concerts.

Besides his wife, he is survived by three children, Ronald, Georgia, and Kenneth, of Riverside, by a brother Clarence Bliss of Bellvue, Colorado, and by his mother, Mrs. Cora Bliss of Greeley, Colorado.

Dr. Bliss dedicated his life to his science and his community, giving the best he had to each. The Date Growers' Institute should be proud of his association with them, and of this opportunity to honor the memory of a scientist and a gentleman.

ELLIS F. DARLEY
University of California
Riverside, California

28th Annual Date Growers' Institute

April 28, 1951

Chairman Morning Session: W. H. Wright, Riverside County Agricultural Commissioner, Riverside, Calif.

Chairman Afternoon Session: J. C. Johnston, Extension Citriculturist, University of California Citrus Experiment Station, Riverside, California.

Report On Date-Insect and Date-Mite Control Investigations

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University of California Citrus Experiment Station, Riverside

The infestation of dates by nitidulid or dried-fruit beetles during the 1950 season was generally light. In the four Deglet Noor gardens in which experimental work was conducted, beetle-infested fruit in paper-covered bunches treated with Thiomate "19" averaged 1.2 per cent, while in the uncovered and untreated bunches the infested dates averaged 6.2 per cent. The number of beetles per pound of fruit in covered bunches dusted with Thiomate "19" was less than 1 per pound, while in uncovered and untreated bunches the average was 13 beetles per pound. Of the four species of dried-fruit beetles found in Deglet Noor dates, more than 99 per cent were *Carpophilus dimidiatus* (Fab.), the corn sap beetle.

Infestation by the date mite was spotted and occasionally caused some injury, but in most cases sulfur dust properly applied gave good control.

Control of the date beetles consisted of bunch dusting and soil treatments, while the experiments conducted on the date mite compared various new acaricides with sulfur. This paper is a progress report of the work conducted during the 1950 season.

Nitidulid Beetles

Field tests during the 1950 season were again conducted on the Khadrawi and Deglet Noor date varieties. A single Khadrawi plot located at Indio, and five Deglet Noor plots located in the Indio and Thermal districts, were used. The experimental dusts applied on both Khadrawi and Deglet Noor varieties were the following: 2 per cent parathion, 2 per cent dieldrin, 2 per cent aldrin, and a mixture of 1 per cent parathion plus 1 per cent dieldrin. In addition, one combination of 2 per cent dieldrin plus Thiomate "19", and another of 2 per cent parathion plus Thiomate "19", were used on Deglet Noor dates.

All dusts were applied with hand-operated equipment, except in one plot in which a Niagara power duster was used. The Khadrawi dates were dusted on July 25, and two weeks after the dusting, the bunches were wrapped with cheesecloth to protect them from birds and bees. Three of the Deglet Noor plots were treated during the first week of September; the other two Deglet Noor plots received an insecticidal-fungicidal combination treatment on August 22 and a second, similar dusting on September 19.

Weekly observations on the Khadrawi dates following applications of the various insecticidal dusts indicated that the dates remained free from infestation with dried-fruit beetles for a period of at least one month, whereas many beetles were found infesting the untreated bunches during this same period. Hundreds of beetles were found dead in the bottom of the cheesecloth covers of some of the parathion-treated bunches. Some of the treated bunches that were not picked or disturbed in any manner after treatment became infested with the saw-toothed grain beetle, *Oryzaephilus surinamensis* (L.), as the dates dried.

Samples of Khadrawi and Deglet Noor dates picked at weekly intervals following treatment were tested to determine whether the deposit on these dates would kill dried-fruit beetles as they walked over them. These dates were placed in glass containers along with a number of dried-fruit beetles, and the number alive after 24 hours was determined. The results are given in table 1. It will be observed that the insecticidal residue on dates treated with dieldrin and parathion killed 100 per cent of the insects confined on these dates 3 weeks after treatment. Although these results are not an indication of what takes place in the field, they do indicate that there is still a toxic residue remaining after three weeks' exposure.

Weekly observations following applications on the Deglet Noor plots indicated some infestation present in the plots treated with insecticides, as well as in the untreated plots. Bunches receiving no insecticidal or fungicidal dusts averaged 2 per cent infested dates, while bunches receiving parathion or dieldrin dusts, averaged 1.0 per cent infested dates. This difference is so small that it is not significant.

Although the bunches were covered, the covers were folded up in such a way as to expose the bunches. In one of the Deglet Noor plots a localized rain following treatment may therefore have washed off the dust to some extent, and in another

TABLE 1.—Percentage Mortality of Nitidulid Beetles after 24-Hour Exposure to Insecticidal Residues on Dates at Various Intervals after Treatment.

INSECTICIDE	KHADRAWI DATES AFTER					DEGLET NOOR DATES AFTER			
	7 days	14 days	16 days	21 days	23 days	1 day	7 days	14 days	21 days
None (cantral)	0	0	25.0	16.2	0	0	20	0	0
2% Aldrin	92.3	23.1	83.3	100	0	100	20	100	100
2% Dieldrin	100	100	100	100	0	100	100	100	100
2% Parathion	100	100	100	100	100	100	100	100	100
1% Dieldrin — 1% Parathion	100	100	100	100	92.9	100	100	100	100

(1) The writers wish ta express their appreciatian ta T. R. Brawn, D. H. Mitchell, K. McBean, L. J. Andersan, the U. S. Date Garden, E. G. Gebhardt, and N. R. Jarvis far their caaperatian in making experimental plats available; and ta F. A. Gunther, af the Citrus Experiment Statian, far the determinations of insecticidal residues.

plot a windstorm may have caused mechanical weathering.

Samples of Khadrawi dates dusted with parathion were picked the day of dusting and at weekly intervals thereafter to determine the parathion residue present. No analysis of the residues of dieldrin and aldrin were made since no chemical method was available for determining these materials. The dates were cut directly from the bunch into glass containers; thus they were not handled in any way prior to analysis. Table 2 gives the results of these analyses. It will be noticed that two weeks after the day of application the residue was only 1.2 parts per million, which is below the suggested tolerance.

Deglet Noor bunches were heavily dusted with a 2 per cent parathion dust to determine the amount of residue removed by the packing-house washing process. Samples for analysis were picked one week after application. The unwashed treated dates had 15.8 parts per million residue present, while the washed treated dates had 1.9 parts per million, an amount which is below the suggested tolerance.

These insecticides are of relatively recent origin, and the potential hazards associated with them have not yet been fully evaluated. These include danger to persons handling or coming in contact with the insecticides at the time of application, and with the residue remaining on the dates. Results indicate that parathion residue remaining on the dates is removed below the accepted tolerance by washing in the packing house.

In the event that nitidulid beetles can be controlled by using insecticidal dusts applied to the bunch, indications are that the application will have to be thorough, and that a toxic residue will have to be kept on the dates. Where infestation is severe, several dustings may be necessary. Until further evidence is obtained as to methods of application, we do not feel that these materials can be recommended for use on dates.

Since the dried-fruit beetles spend part of their life cycle in the soil, tests with new insecticides applied to the soil are being continued. During the 1950 season, dieldrin at the rate of 2, 4, and 8 pounds per acre was dusted on the surface of the soil and raked in. The treated surface was then covered with heavily infested dates which were allowed to remain on the soil for one week, after which they were removed. This allowed the mature larvae from the infested dates to enter the soil, pupate, and emerge. In order to capture any emerging adults, cages were placed over these infested areas.

TABLE 2.—Results of Chemical Analysis of Parathion Residue Remaining on Dates at Various Intervals after Treatment.

TREATMENT	Parathion residue (Parts per million) after 1 day	7 days	14 days	21 doys
None (control)	0	0	0	0
2% Parathion	6.2	3.6	1.2	0.5

In the plots receiving the lowest dosage of 2 pounds per acre, 75 to 98 per cent of the beetles failed to emerge one month after treatment. Any program involving soil treatments would necessitate treatment of large areas, since these beetles tend to migrate in their search for food.

Date Mite

In 1950 the date mite, *Paratetranychus simplex* (Banks), and its eggs were observed on bermuda grass in date gardens as early as the first week in April, and by the middle of May the mites were beginning to appear on dates. By June 1, the bunches were becoming heavily infested with mites.

Several new acaricides were tested against the date mite on heavily infested bunches. The effectiveness of these acaricides when applied as dusts was as follows:

Acaricide	Days Effective
Pextox III (1 pt./100 gal.)	0
1% Dieldrin	0
5% 5571	0
5% 5572	0
5% 5860	0
5% 4049	0
5% R242	0
4% DMC	19
Sulfur	41

Only one of these new acaricides, 4% DMC, gave any control, and the dates treated were severely injured. Sulfur, properly applied, controlled the mite effectively for a period of 41 days. It was interesting to note that sulfur applied just prior to a wind and dust storm had practically no effect, probably because the wind and dust removed the sulfur from the bunches. These same bunches were re-treated with sulfur one week after the wind storm, and remained free of mites for the remainder of the season. It is still thought that a good deposit of sulfur throughout the bunch is essential to obtain effective control of the date mite.

Summary

During the 1950 season, Khadrawi and Deglet Noor date bunches were dusted with the following insecticides: 2 per cent parathion, 2 per cent dieldrin, 2 per cent aldrin, and a mixture of 1 per cent parathion and 1 per cent dieldrin. Although the population of dried-fruit beetles was light and it was difficult to determine differences, it appeared that dieldrin and parathion showed promise in controlling these beetles.

These materials appear to be toxic to dried-fruit beetles for several weeks after application. Analysis of dates washed in the packing house indicates that the parathion residue is below the suggested tolerance. Residue analyses for dates treated with dieldrin and aldrin are not available.

Dieldrin applied to the soil at the rate of 2 pounds per acre considerably reduced the number of beetles emerging from the soil.

Of eight new acaricides tested against the date mite, none approached sulfur in effectiveness in controlling this mite.

Progress Report on Rhizosis or Rapid Decline of the Date Palm

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Citrus Experiment Station, Riverside

The sudden wilting and death of large date palms, a disease known variously as rhizosis or rapid decline, continues to be a serious problem in some date gardens in the Coachella Valley. Although the cause of rhizosis or rapid decline is still unknown, it is the purpose of this report to recall the disease to the growers' attention and to give the present status of investigations on this problem.

HISTORICAL REVIEW

The disease was first described by Bliss in 1933, and during the next three years he observed some 21 diseased palms in 10 gardens (1). His observations indicated the trouble to be essentially a root rot. Several fungi were isolated from dead roots. One of these, a species of *Ceratostomella*, was shown to be pathogenic to the roots of seedling date palms and was later described under the name *Ceratostomella radicicola* Bliss (2). This fungus was at first thought to be the primary cause of the disease.

In 1940 there was another outbreak of the disease. One garden lost about 80 trees. Although the pathogenicity of *C. radicicola* had been demonstrated, its presence in the roots of diseased palms was demonstrated in less than one-half of the cases. This raised the question as to whether some other casual factor might be involved. Bliss (3) concluded that it "Cannot be definitely stated that *C. radicicola* is the cause of rhizosis, for many mature palms die suddenly with all symptoms of rhizosis *except* the presence of *C. radicicola* in the roots."

By 1947 KenKnight had observed many diseased palms during the survey for omphalia root rot. He stated that more than 100 palms died in 1946 and no more than 50 in 1947 (4). He estimated that more than 600 palms had died since 1930 but that the majority of these occurred as ornamentals in residential lots or guest ranches.

The writers were not able to determine the exact numbers of palms that have died since 1947 but several gardens have lost some trees each year. The total would probably exceed 50.

Bliss (1) believed the primary symptom of the disease was a root rot and named the disorder "rhizosis," meaning a disease of the roots. KenKnight (4) apparently believed that the rotting of roots was a delayed and secondary symptom; that fruit drop, wilting of the crown, and rotting of the center leaves were primary symptoms. If such were the case, the name "rhizosis" would not be applicable and he suggested the name "rapid decline."

Since the cause of the disease is still unknown, insisting on the use of one name over the other seems relatively unimportant. It is evident that both names apply to the same disease condition. Rhizosis has priority and the writers will use that name in the present report. To some growers the name "rapid decline" suggests a relationship to the quick decline of citrus, which is a virus disease. There is no evidence at present to indicate that the date disorder is a virus, although such a possibility is being considered. It is hoped that its cause will soon be determined.

PRESENT INVESTIGATIONS

Distribution

In figure 1 is shown the location of 56 palms that died of rhizosis during the period May to December, 1950. Thirty of these were in commercial gardens, the remainder occurring more or less as ornamentals on guest ranches. KenKnight (4) noted that the disease was most prevalent in the northwest end of the Valley and in general this still holds true. No diseased palms were found east or south of La Quinta. The highest prevalence was in the La Quinta area.

Symptoms

The symptoms of palms affected by rhizosis may become apparent any time from April to December but new cases are found more frequently from June to September; such trees may die in 1 to 6 months (Fig. 2). In fruiting palms the first visible symptom is usually a shattering or shriveling of the fruit accompanied by wilting and discoloring of the fruit strands. Only 2 or 3 bunches may be affected at first. At the time of fruit drop there may or may not be any leaf symptoms. If present, leaf symptoms are manifest in one of two ways. Either the tightly folded central or terminal leaves will be found to be dead, white and stiff (Fig. 3), or the pinnae of the lower leaves may turn a chocolate or reddish brown and such leaves wilt and die. Death of the lower leaves progresses upward from the lower whorls. The last leaves to die are those in the cluster surrounding the terminal leaves.

The order in which the leaf symptoms appear is not always the same. The terminal, unfolded leaves may die before any others, or the lower whorls of leaves may start to die first. In general the terminal leaves die before many of the lower leaves are affected.

In male palms, leaf symptoms are the first outward indication of any disorder and they occur as stated for fruiting palms.

Once the terminal leaves die it is possible to pull them out of the cluster with relative ease. In fact at times the slightest wind may blow them out of the crown. The petioles of these leaves are rotted. KenKnight called this condition heart rot (4). This has suggested to some growers that the disorder originates in the bud. Several diseased palm trunks were dissected in the vicinity of the bud. In every case the bud appeared to be firm and healthy and was free of organisms. One palm was dissected the day after its fruit started to drop. There were no leaf symptoms, nor any indication of disorder either in the bud or on the petioles of the terminal leaves. On the other hand, on palms in which the terminal leaves had died, the petioles were rotted and the disintegration seemed to be due to the

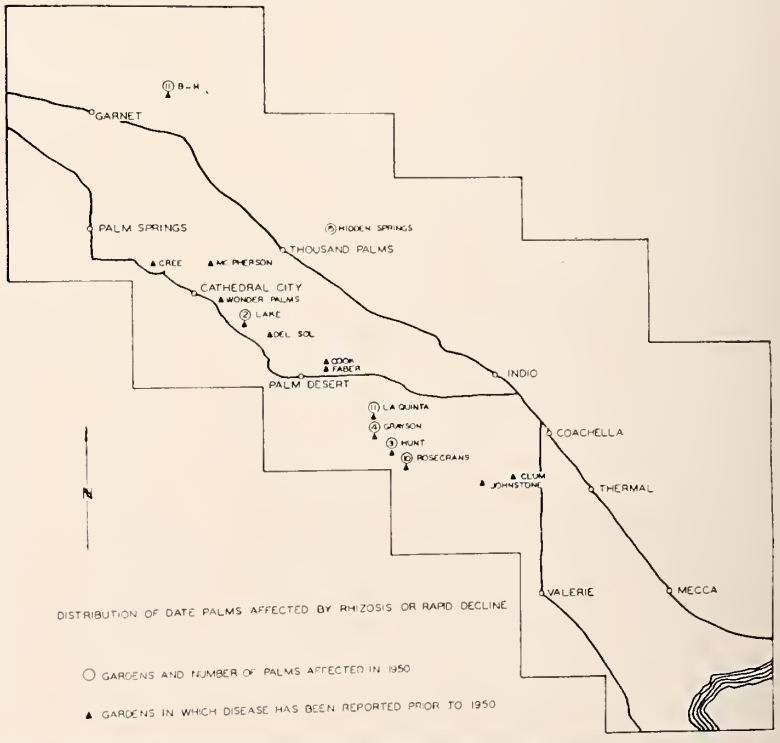

FIGURE 1. Coachello Valley of Colifornio showing distribution of Rhizosis or Rapid Decline.

FIGURE 2. Date palm affected by rhizosis. A. June 7, 1950. Only visible symptom wos fruit shottering from a few bunches. Most af the small secondary roots were deod and Pythium sp. wos readily isolated. The terminal leaf died during July. B. November 3. All af the leoves were dead and most af them were draaping.

combined action of bacteria, molds, and fly maggots. The decay was progressing downward toward the bud (Fig. 3B), and undoubtedly would have reached the bud eventually.

Examination of the roots of diseased palms revealed that varying proportions of the small secondary roots were discolored and dead. At this early stage the larger primary roots were usually firm, white, and healthy appearing. Eventually, however, these roots also died.

Since it is impossible to predict which trees will be affected, it has thus far been impossible to determine whether root or crown symptoms occurred first. This point is emphasized because it represents a fundamental difference of opinion in the literature. Whereas Bliss (1, 3) believed that root rot was a primary symptom and that top symptoms were secondary, KenKnight (4) believed that rotting of roots was a delayed and secondary symptom to that of wilting of the crown.

The majority of diseased palms found in 1950 were not brought to the writers' attention until fruit and leaf symptoms were well established. In these instances practically all of the secondary roots were dead. In a very few cases, however, where palms were examined within a day or two of when the fruit began to fall and where there were no symptoms on any leaves, it was estimated that from less than one-third to more than two-thirds of the smaller roots were dead. Thus, where it was possible to follow the order of events, rotting of the roots accompanied the beginning of fruit shattering and preceded the appearance of leaf symptoms. Therefore, it would appear at present that the disease is essentially a root rot.

One fact, however, is difficult to explain if the disease is a root rot. KenKnight noted that offshoots, if present, usually survived. Two cases have been noted where this condition exists. In one the parent palm died and was removed in 1944. The offshoot is still in place, and growing and producing fruit normally. The second was a male that died the past year leaving a large offshoot which apparently is still healthy.

Another observation over the years is that palms usually died singly and not in groups. In general this is still true and does not follow the usual pattern of a root rot disease. Several of the diseased palms found in 1950, however, were adjacent to trees that died in 1949. Not only were two or three adjacent palms affected but in one garden a group of 7 trees died in the past two years. A similar situation must have existed in the garden that lost 80 trees in 1940.

Isolations

Assuming that rhizosis was a root rot, isolations were made from the small secondary roots of many of the diseased palms. Many different fungi and bacteria were obtained. A species of *Pythium*, belonging to a group of fungi well known as a cause of root rot of a variety of plants, was obtained rather regularly, especially from plants recently affected. *Ceratostomella radicicola* was also isolated in conjunction with *Pythium* sp. from a few of the palms.

Inoculation Studies

Because *Pythium* is well known as a root rotting organism, it was selected for preliminary inoculation studies on date seedlings grown in

FIGURE 3. A. Dead terminal leaf hanging aut of center of crown and surrounded by unaffected green, narmal appearing leaves. Lawer whorls af leoves and fruit stalks had died and been removed. B. Trunk of palm split in the regian af the bud ond shawing the dead terminal leaves. Rat af the succulent petioles hod pragressed dawnward to within 12 inches af the bud (indicoted by knives). The bud tissues appeared to be healthy and were free af arganisms.

the greenhouse. So far these tests have given negative results.

That *Ceratostomella radicicola* is pathogenic to the roots of seedling dates has been established (1, 3). Similar trials were repeated by the writers. The fungus attacked the roots of several of the seedlings and some of the palms died rapidly. However, seedlings that had reached a diameter of one inch or more at the basal internode, were unaffected in the tops even though some of the roots were killed.

Both *Pythium* sp. and *C. radicicola* have been used as inoculum around the roots of large palms in one of the affected gardens in the Valley. The results may not be available until the coming summer when rhizosis can be expected to develop.

Additional inoculations will be made on seedlings using *Pythium* sp. as well as other organisms obtained from the roots of diseased palms.

Control

No control is known at the present time. There appears to be no varietal resistance, as several varieties have been affected. Assuming that the disease is a root rot, the soil around several palms located adjacent to diseased palms was treated to a depth of 4 feet with copper sulfate and Dithane D14. On April 18, 1951, the recently set fruit began to drop from one of the palms receiving the copper sulfate.

SUMMARY

Rhizosis or rapid decline of the date palm continues to be a serious problem in the northwest end of the Coachella Valley of California. Fifty-six trees were killed in 1950. The symptoms, which usually appear during the summer months, are a sudden dropping of the fruit and wilting of the fruit strands, and wilting and death of the crown leaves. Root rot is also an early symptom and appears at least to precede the wilting of the crown.

Described first in 1933, the cause of rhizosis is still unknown. Several fungi obtained from diseased roots, including *Pythium* sp. are being studied. Results of inoculations with some of these fungi were inconclusive. The possibility that the disease is due to a virus is also being considered.

There appears to be no varietal resistance and no control is known.

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The Influence of Irrigation and Bunch Management Upon Shrivel of the Maktoom Date

By G. C. Sharples and R. H. Hilgeman
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The Maktoom date is soft, medium to large in size, oblong-oval in shape and ripens to an amber or reddish-brown color late in the season. It is rather tolerant to rain so that little checking and blacknose commonly occur. However, serious losses have occurred from shrivel during the khalal stage just prior to the ripening of the fruit. This condition has been present in all commercial plantings since their inception. Its intensity varies greatly in different years, and slightly in different gardens in the same year. Since soil moisture is known to affect shrivel of Halawi and Deglet Noor dates (3, 4) it was considered pertinent to first study this factor. Thinning practices are also known to affect shrivel (2, 3) and paper bunch protectors may influence it, so an evaluation of these factors was made concurrently.

Methods

A cooperative experiment was initiated at the Mehren date garden northwest of Glendale, Arizona, in March, 1949. The palms were growing in a loam soil of high moisture holding capacity, underlaid with a gravelly calcareous sub-soil. Three irrigation schedules were established:

A. Frequent irrigation throughout the season at intervals necessary to maintain maximum palm growth (summer interval 11 to 14 days);

B. Frequent irrigation as in A until a short time prior to ripening, then infrequent irrigation for the remainder of the season (intervals dependent upon palm growth);

C. Infrequent irrigation throughout the season so that palm growth was always retarded (summer interval 21-28 days).

Each plot consisted of five palms, with guard rows on all sides. It was not possible to replicate the treatments. Soil moisture in the upper four feet was followed from oven dried samples. Growth responses to irrigation were determined by measuring the elongation of the spike leaves. as demonstrated by Aldrich, et al (1). The experiment terminated in December, 1950, when the grower decided to remove the garden.

1949 Results

Soil Moisture and Leaf Elongation. In the "C" plots, which were irrigated on the normal irrigation program in the Mehren garden, the upper four feet of soil dried to the wilting range between each irrigation. The rate of elongation of the leaves on the palms was markedly retarded during the 10-14 day period prior to each irrigation (Figure 1). The additional water applied to the A and B plots gradually increased the general level of soil moisture so that by early summer a continuous high rate of leaf elongation was attained. In the B plots the program of placing the palms under stress by the reduction of soil moisture in the fall was not accomplished because an unscheduled irrigation was applied and a heavy rain (1 inch) occurred on September 10.

Palm Growth. The palms were fairly uniform in height and number of leaves. They carried an average of 77 leaves at the initiation of the experiment. About 30 of the oldest leaves had been seriously damaged by freezes during 1948 and 1949. During 1949, the palms receiving frequent irrigations produced an average of 24.5 leaves and from 6-10 of the old damaged leaves died; whereas palms irrigated infrequently produced only 20 leaves and 26 old leaves died (Table 1).

Yields and Fruit Quality. The bunches on the palms in treatments A and B were thinned by removing one-third of the center strands, but through an error, treatment C was unthinned. Therefore, the differences in the size of the fruit, yields, and shrivel could be related to thinning as well as to irrigation (Table 1).

After the September 10 rain, moderate to severe checking of fruits developed in the frequently irrigated plots. This was followed by an intense shrivel and blacknose condition which ultimately resulted in an average loss of 57% of the crop, not including mechanical injuries (insect, bird damage, etc.), which were

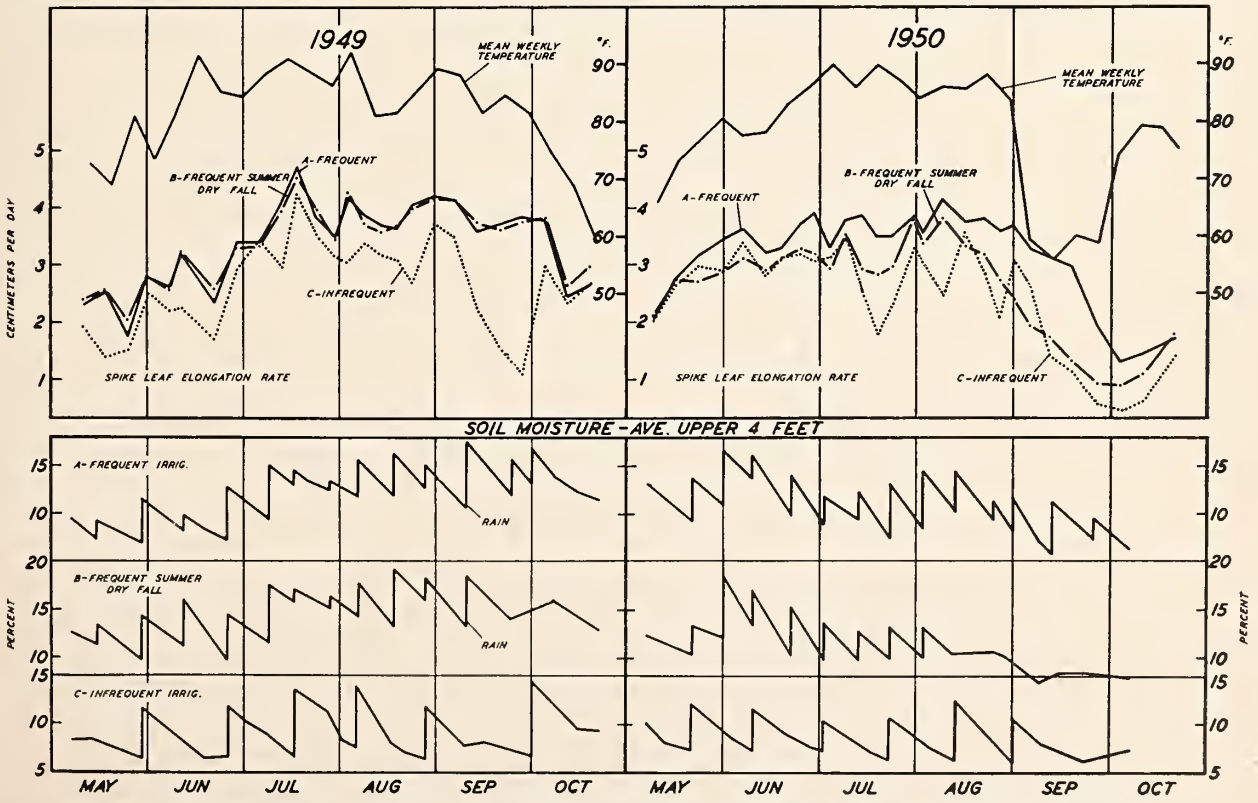

FIGURE 1. The Influence of Three Methods of Irrigation Upon the Spike Leaf Elongation Rate of the Maktoom Date Palm.

not affected by irrigation treatment. Infrequently irrigated palms, which were under a severe moisture stress at the time, had little or no damage from checking and blacknose and only a 4.3% loss occurred from shrivel.

1950 Results

Soil Moisture and Leaf Elongation. The experimental procedure differed in the second year in that a lesser amount of water was applied at each irrigation so that the general level of soil moisture decreased during the summer (Figure 1).

The rate of leaf elongation in the A plot palms appeared to be slightly retarded by soil moisture deficiencies between irrigations in July, August, and September. The B plot received less water than the A plot and the soil moisture was maintained nearer the lower level of available water. This resulted in an intermediate rate of leaf elongation on these palms during July and early August. Water was withheld after August 2. The deficiencies in soil moisture which followed restricted the rate of leaf elongation to 52% of the rate in the A plot palms during September. Sufficient water stresses developed in plot C during the 7 to 14 period after each irrigation during July, August, and September to markedly reduce the rate of leaf elongation of the palms.

Palm Growth and Inflorescence Production. Between January 4-7, 1950, a serious freeze (17°F.) damaged all the leaves on the palms. The partially damaged leaves on the A and B plot palms which remained green during 1949 all died during 1950, so there was no gain in the number of leaves in the two year period. While a lesser number of leaves died on the palms in the C plot, the total decreased so that there were only 59 leaves in December, 1950.

The A and B treatments during 1949 induced the differentiation of an average of 11 inflorescences per palm whereas the C treatment produced only 9 inflorescences per palm for the 1950 crop. Data for the 1951 crop could not be obtained because the palms were removed.

The spathes opened 10-14 days earlier on the A and B plot palms than on the C plot palms. Ripening, however, started and was completed earlier on the C plot palms than on the A plot palms.

Yields and Fruit Quality. To evaluate the effect of thinning which was involved in the 1949 experiment, half the bunches on each palm were left unthinned and the remaining half were thinned to 36-38 strands by removing ⅓ of the center of the bunch.

TABLE 1

Effect of Irrigation Upon Growth, Fruit Production and Quality of the Maktoom Date Palm

	1949			1950		
PLOT	A	B	C	A	B	C
Ave. palm grawth (Inches)	14	13	9	9.2*	9.1*	7.8*
Ave. na. lvs. prad. per palm	25	24	20	21*	20*	18*
Ave. na. lvs. died per palm	10	6	26	36*	43*	29*
Tot. no. lvs. per polm	92	96	70	77*	73*	59*
Inflar. prod. per palm	7.1	7.1	6.4	11	11	9.0
Inflor. fruited per polm	6.6	6.2	6.0	6.6	6.8	6.4
No. strands fruited per bunch	34	36	46	—	—	—
Tatal yield, lbs. per palm	76	77	85	111	97	92
Weight per fruit, gms.	23	24	17	20	18	15
Commercial grades, %	38	31	87	82	89	91
Loss due ta shrivel, %	37	33	4	10	4	1
Loss due to blacknase, %	17	28	0	—	—	—
Mechanical damage, %	8	8	9	8	7	8
Totol loss, %	62	69	13	18	11	9

* 1950 record from March ta December. 1950 grades, yields, ond weight per fruit are cambined data from thinned and unthinned bunches.

The 1950 ripening season was dry, no checking or blacknose and relatively little shrivel occurred, and between 82% and 91% of the crop was commercial fruit. Although the amount of shrivel which did develop was greatest on the palms in the A plot, 69% of the total amount developed on only two of the five palms.

Thinning the bunches significantly increased the size of the fruit but did not affect shrivel (Tables 1, 2). Irrigation treatment B reduced the moisture content of the fruit as compared with the A treatment, but did not affect the dry weight of the fruit. Irrigation treatment C, however, reduced both the fresh and dry weight of the fruit. Consequently it is evident that the reduction in fruit size which occurred the previous year was not due entirely to thinning.

Sub-samples of fruit taken at different times during the season were cured at 105-110°F. with 75% humidity for 2-4 days and graded. Much of the slightly shriveled fruit recovered its turgor and was classed as No. 1 after curing. A ten per cent loss of fruit caused by excessive darkening occurred on the fruit from the A plot.

Effect of Bunch Protectors Upon Shrivel

In 1949 bunch protectors were compared as follows: (1) brown waxed, ripple craft paper bags which extended below the bunch; (2) Similar bags reduced in length until only the top of the bunch was protected in umbrella fashion; (3) cheese cloth bag surrounding the bunch; (4) control, unprotected. Each type of protector was placed on each palm in the A, B, and C plots in early September just prior to the heavy rain.

Damage to fruit on the palms in the C plot was not significantly affected by the protectors. On the A and B plot palms, however, both types of paper protectors significantly reduced the amount of blacknose (Table 3). The data indicated that the paper bags increased shrivel. However, a small amount of shrivel was frequently associated with blacknose fruit. We feel that the proper interpretation of these data is that shrivel would have developed about equally in all treatments had no rain occurred. Thus, because the paper protectors reduced the amount of direct rain injury, an apparent increase in the amount of shrivel occurred.

In 1950, bags cut off at the level of the tip of the bunch were placed on early, midseason, and late maturing bunches which were both thinned and unthinned. Neither age of the bunch, bagging, nor thinning influenced the amount of shrivel. However, the detailed data from each palm revealed that significant differences in the intensity of the shrivel existed between palms, and that wide differences occurred between bunches on the same palm regardless of treatment.

Discussion

Since the irrigation treatments were not replicated, these data cannot be analyzed statistically. However, because of the wide differences which developed between the treatments, we feel that real differences occurred and that the amount of shrivel was significantly reduced by

TABLE 2

Effect of Irrigation and Thinning Upon the Fruit Size and Percentage of Shrivel

	IRRIGATION TREATMENT					
	A		B		C	
THINNED	YES	NO	YES	NO	YES	NO
Fresh wt. gr/frt.[A]	21.6	18.0	19.4	17.1	16.4	14.0
Dry wt. gr/frt.[A]	7.0	6.3	7.6	6.9	5.8	5.3
Moisture[A] %	68	65	61	59	65	62
Shrivel[B] %	10	9.7	3.5	4.1	1.0	1.7

[A] Data obtained Sept. 14, an kalal fruit.

[B] Percentage af shriveled fruit far entire seasan.

growing the palms under water stress conditions.

These results are not in agreement with the findings of Reuther (4) who reduced shrivel on Deglet Noor palms growing in sandy soil by providing a constant supply of water. Neither are they in agreement with the results of Nixon (3) who demonstrated that withholding irrigation between July 16 and Sept. 15, increased shrivel in the khalal stage of Halawi fruit. However, in the same test he induced a significantly larger amount of shrivel by very heavy thinning. He previously had reported that severe thinning caused an increase in blacknose in Deglet Noor fruit. This relationship suggested to him that thinning may produce a change in the structure of the cuticle or epidermal layer so that possibly the factors which make Deglet Noor fruit more susceptible to blacknose, also make the Halawi fruit more susceptible to shrivel.

It is possible that inherent differences between the Maktoom and the Halawi or Deglet Noor account for the different results in our experiment. However, the reduction in the size of the fruit with possible accompanying secondary effects upon anatomical features produced by stress periods during the period of rapid fruit growth may offer the best explanation. It is conceivable that the large fruit produced by heavy thinning or frequent irrigation may be characterized by large, thin-walled cells which are easily ruptured during any period of abnormal stress.

Although it is clear that infrequent irrigation has reduced field losses of fruit, it also is evident that this program reduces palm growth and inflorescence production. It appears that the program of frequent irrigation in the spring followed by non-irrigation after early August will minimize shrivel and rain damage losses and maintain moderate fruit size, palm vigor, and production. We feel that this program is the best one to follow until further data is obtained.

Summary

Three methods of irrigating Maktoom date palms were tested for a two-year period in central Arizona. A; Palms grown with a high level of soil moisture produced large, late ripening fruit which sustained heavy losses from shrivel and blacknose. Maximum palm growth, leaf development and inflorescence differentiation occurred on these palms. B; Palms grown with a high level of soil moisture in the early summer and a low level between August and November produced slightly smaller, earlier ripening fruit which sustained lesser losses from shrivel and blacknose than A. Palm growth and leaf development was less than in A, but inflorescence differentiation was equal. C; Palms grown with a low level of soil moisture produced early ripening, small fruit which sustained very light losses from rain damage and shrivel. Palm growth, leaf development and inflorescence production were markedly less than in A.

Protection of bunches with paper bags significantly reduced blacknose in 1949 but did not reduce shrivel. In 1950 differences in the amount of shrivel between bunches on the A and B plot palms could not be associated with age of bunch, thinning or paper protectors.

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TABLE 3

Effect of Bunch Protectors Upon the Development of Blacknose and Shrivel in the A & B plot Palms

	Cantral	Cheeseclath Bag	Lang Bag	Shart Bag	L.S.D.
Blacknose, %	33	31	13	15	7
Shrivel, %	34	30	41	38	8
Total, %	67	61	54	53	

The Anatomy and Development of the Leaf and Stem of the Date Palm

By R. H. Hilgeman,* University of Arizona Citrus Experiment Station, Tempe, Arizona

*The writer wishes to acknowledge the stimulating suggestions and assistance of Dr. F. Murray Scott of the Botany Department of the University of California at Los Angeles under whose direction this work was accomplished.

Since the introduction of the date palm in the United States about 50 years ago, physiological and taxonomic studies have been made but almost no attention has been given to the anatomy and development of the plant. Information presently available consists of isolated descriptions of different tissues from various species of Palmaceae (1, 2, 3, 4).

Methods and Materials

The descriptions presented herein are based upon observations of tissues obtained from 38 year old Rhars palms in the University of Arizona Date Garden near Tempe, Arizona, from young seedling palms,

offshoots, and a 26 year old Khadrawi palm in the U. S. Date Garden near Indio, California, and from Khadrawi offshoots grown in the University of California Subtropical Orchard at Los Angeles. Shoot apices and young leaves were killed and fixed in formalin-acetic acid-alcohol solution, dehydrated with butyl alcohol, imbedded in paraffin, sectioned, mounted, and stained for microscopic observations. The vascular pattern in the upper stem was observed after the tissue had been cleared by boiling in chloral hydrate and staining with phloroglucin and hydrochloric acid. The vascular pattern in the trunk of the palm was followed by dissection after the injection of eosin solution into roots and leaves.

Anatomy

The general features of the anatomy of the palm are diagramatically illustrated in Figure 1. Growth originates and leaves differentiate from the shoot apex which is a blunt rounded cone situated in the center of the bowl-like upper portion of the stem. Cell division in a meristem at the base of the corpus (the inner core of the shoot apex) provides ground tissue (parenchyma cells) for the central core of the meristele (the main trunk or axis). A second meristematic zone 4 to 6 cells in thickness is present beneath the developing leaves. This zone, which is designated the mantle meristem, extends from the shoot apex over the lip of the bowl and down the sloping side of the meristele (dotted area beneath the leaves). The mantle meristem originates from the corpus meristem beneath the newly differentiated leaf. Cell division in the mantle, which is largely independent of that in the shoot apex, provides the major portion of the ground tissue of the meristele. After cell division ceases this zone becomes the pericycle where adventitious roots (all the roots on an offshoot) arise.

Outside the pericycle an indefinite zone which blends with the leaf bases forms the cortex. It is made up chiefly of fiber bundles and small parenchyma cells. Within the pericycle is the meristele which contains the main vascular system of the palm. Vascular strands, which are scattered throughout the ground tissue, are smaller and more numerous near the periphery of the meristele than in the center. Those in the center enter the meristematic leaf first so they are designated primary strands; whereas, those near the periphery which enter the leaf later in its development are considered secondary. The parenchyma cells which comprise the ground tissue contain starch.

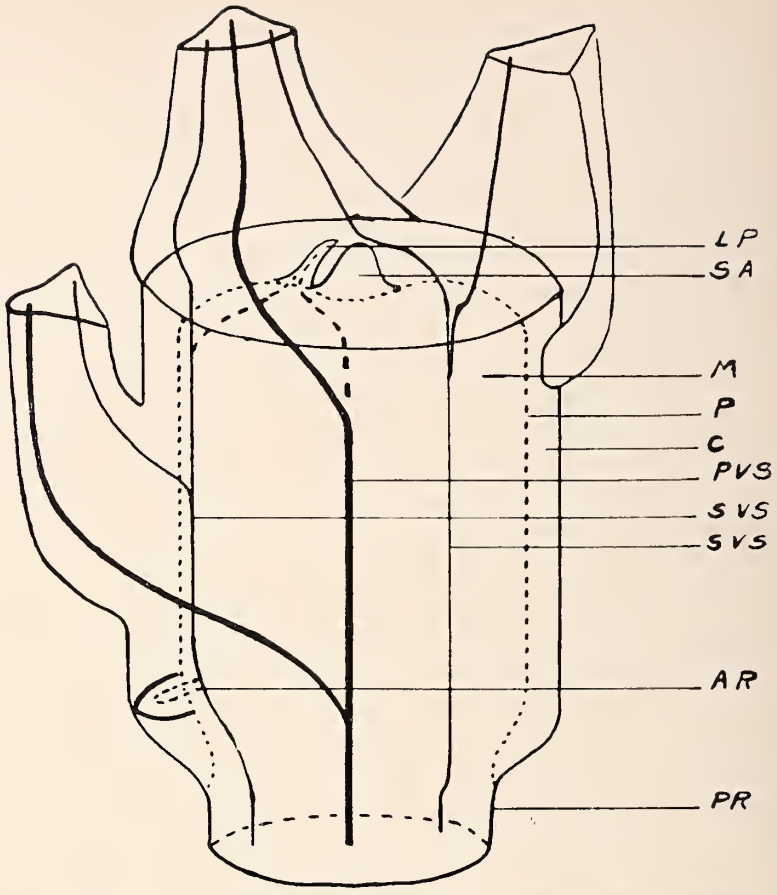

FIGURE 1. Diagram representing the basic pattern of the vascular system in palms. L. P. youngest leaf primordium; S.A. shoot apex; M. meristele; P. pericycle; C. cortex; P.V.S. primary vascular strand; S.V.S. secondary vascular strand; A.R. adventitious root; P.R. primary root (upper portion).

The continuity of the vascular system is effected by the differentiation of branches from the axial vascular strands. For clarity and simplicity only a single primary strand in the center of the axis and two secondary ones in the periphery are indicated. The primary vascular strand has branched from the oldest leaf (indicated on the lower left) to enter a younger leaf higher on the palm. A procambial strand (indicated by the dotted line) also branches from the axial strand below the shoot apex to enter the newly differentiated meristematic leaf. In old mature palms, branches enter leaves separated by 36 or more leaves. In the upward differentiation of these strands they may form a spiral, but in all cases they remain at approximately the same distance from the periphery of the meristele.

The secondary vascular strand near the periphery on the left enters the right side of the mature leaf and then branches to enter the left side of the leaf above it. A procambial strand branches to enter the meristematic leaf. In mature palms many branches enter the 6th and 9th leaves above a base leaf. These leaves are situated slightly offset to the left and right of the base leaf. Thus, there is a close continuity between the leaves in a rather narrow zone on any side of a palm. However, small strands from 1/8" to 1/2" in length connect the adjacent strands in all parts of the palm, so that the entire vascular system is integrated.

The Vascular Strand

The transverse section of a vascular strand from the central portion of a Deglet Noor seedling palm illustrates the typical slightly pointed oval shape of the strand (Figure 2). At the tip, which is oriented internally, are small protoxylem and two large metaxylem elements which conduct water and nutrients from the soil. Xylem parenchyma with large simple pits surround these elements and connect them with the adjacent ground tissue. The small V-shaped area immediately inside the metaxylem is the phloem which contains 18 sieve tubes and a larger number of companion cells. Surrounding the phloem and extending outward in the form of a large thick crescent are many fibers. Secondary thickening of the fiber walls occurs over a period of several years. As

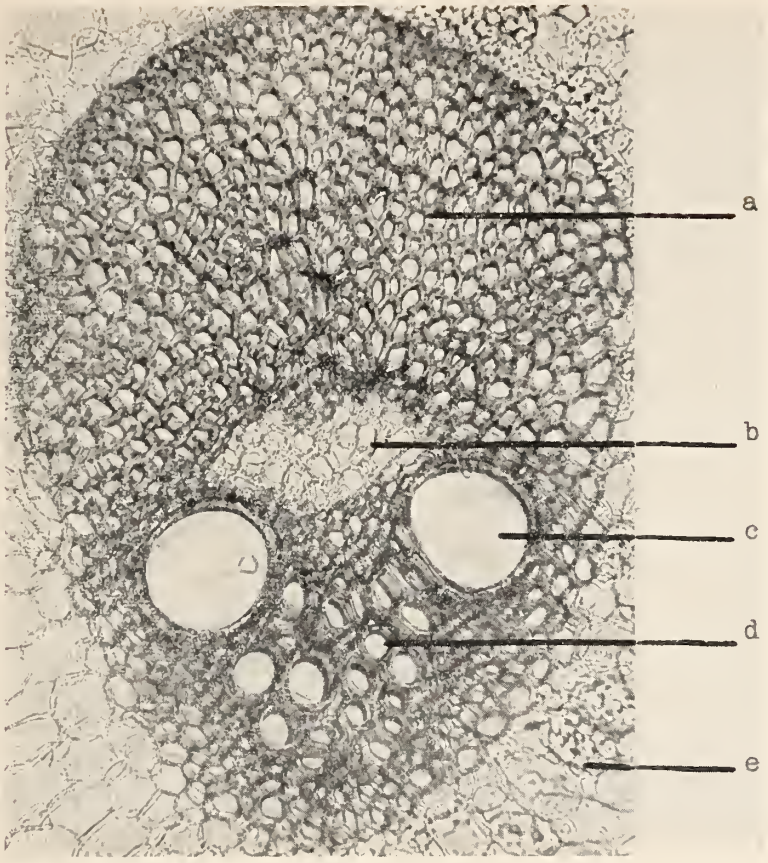

FIGURE 2. Vosculor Strond from the center of the Meristele of o Deglet Noor Seedling Polm. o, fiber crescent; b, phloem; c, metoxylem; d, protoxylem; e, ground porenchymo. Enlorged 117 times.

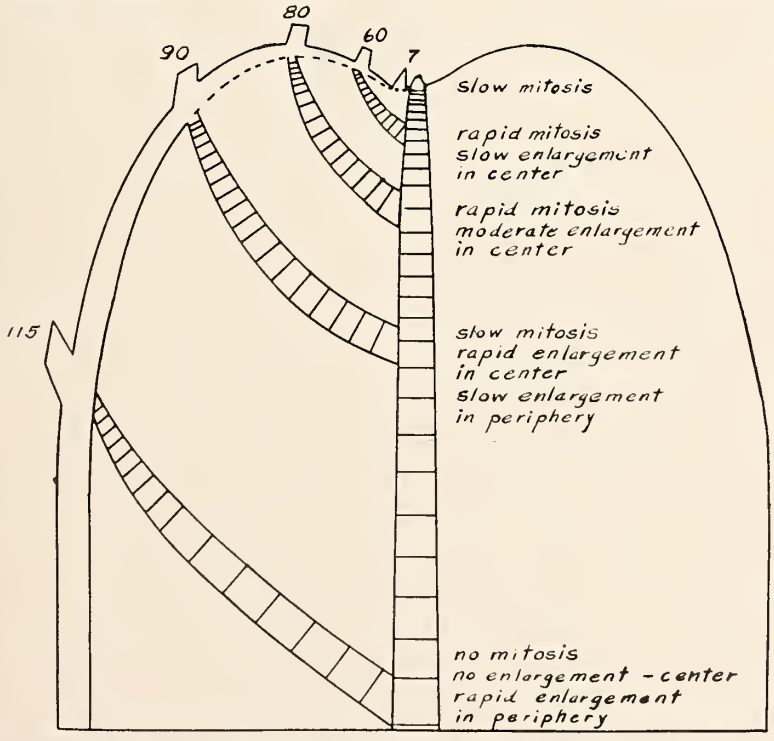

FIGURE 3. Diogrom representing the postuloted mode of enlorgement of the meristele in o moture polm. Leoves numbered on left side of figure. Leof development stoges ore os follows: 1-7 stoge 1; 8-60 stoge 2; 61-80 stoge 3; 81-115 stoge 4. Bosed upon onnuol leof production of 20 leoves. Dotted line represents zone where cell division occurs in the montle meristem. Blocked orcs represent enlorgement of ground porenchymo cells.

many as seven zones of lignin. each separated by a zone of suberin-like material, may occur.

The vascular strands of the leaf and inflorescence axis differ from those in the meristele as follows: leaf strands; about one-half the size, oval shape metaxylem in the center, phloem about 200% larger. two fiber crescents (one on each side of the strand), smaller fibers with thinner cell walls: inflorescence axis strands; about $^1/_3$ the size. almost circular in shape, metaxylem in center with frequently 3 small elements, phloem area 100% larger, smaller fibers surround the entire strand. Limited observations upon strands in different varieties of palms indicate that rather marked differences exist between the detailed features of the strands in each variety.

Leaf and Stem Development

The development of the leaves and the meristele in a mature palm that produces 20 leaves per year is diagramatically illustrated in Figure 3. New cells produced by the mantle meristem and the enlargement of these cells causes the leaf to be moved outward and upward from its point of differentiation from the shoot apex. Thus, each leaf is subtended by an arc of cells which extends from the center of the palm to the leaf base. Cell enlargement within the meristele begins with the oldest cells in the center and proceeds outward ending with the youngest ones beneath the mature leaf. This process extends over approximately six years.

The enlargement of the meristele may be followed most readily by correlating it with the development of the leaves which may be arbitrarily classified into four stages.

Stage 1. Leaves 1-7 (age 0-4 mo.) are meristematic primordia in which the fiber sheath that encircles the axis and pinnae are differentiating. They are associated with almost no cell enlargement in the meristele.

Stage 2. Leaves 8-60 (age 5-36 mo.) are slowly enlarging meristematic primordia ranging from 2 to 45 millimeters in length. This stage is associated with accelerated cell division in the mantle and the initiation of cell enlargement in the meristele.

Stage 3. Leaves 60-80 (age 37-48 mo.) involve leaves which are rapidly elongating. When elongation is complete (at ahout 500 centimeters) the pinnae unfold and the leaf becomes functional. Rapid cell division occurs in the mantle meristem and the rate of enlargement in the meristele gradually increases.

Stage 4. Leaves 80-115 (age 48-66 mo.) are fully mature in their upper portions but their bases con-

tinue to enlarge to keep pace with the meristele. Cell division in the mantle meristem ceases during this stage, and cell enlargement in the meristele proceeds most rapidly. During this period approximately 85% of the enlargement of the meristele occurs. Inflorescences are found in the axils of these leaves.

It is concluded from the above observations that the small trunk areas frequently observed on palms felled by high winds are small because the offshoot was planted so high that most of the enlargement of the trunk occurred above the ground level several years after it was planted. It is obvious that by planting offshoots deeper this condition can be remedied.

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Fruit Thinning Experiments With the Medjool and Barhee Varieties of Dates

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During the 1950 season at the U. S. Date Garden studies were made of fruit thinning by removing indivual dates from strands of the Barhee and Medjool varieties. Size of fruit may be increased in this way as well as by cutting back the tips of the strands, which is the usual practice with the Deglet Noor variety, and there is the additional advantage of better spacing of fruit on the strands. Thinning by removing individual dates has been done by a few growers of fancy soft dates, especially in Arizona, but it has not found much favor in the Coachella Valley primarily because of the time and expense involved.

Barhee Experiments

Barhee is a small to medium-sized soft date, which has been increasing in popularity. It has generally brought a premium on the market. Thirty palms were used in these experiments: 21 were 7 years of age and 9 were 13 years of age. As this variety has very long strands, the tips of all the flower clusters were cut back at time of pollination enough to remove about one-fourth of the flowers or fruits; then at the end of the pollination season (the last week in April) three different fruit thinning treatments, each with 3 large palms and 7 small palms, were made. In Treatment A, one-third of the total number of strands on each bunch was removed from the center of the bunch. In Treatment B, the same proportion of strands was removed from the center as in Treatment A and in addition individual fruits were removed from the strands so as to eliminate crowding. In Treatment C, all the strands except the outer circle were entirely removed, usually a reduction of about two-thirds in the total number per bunch.

The average number of strands per bunch before thinning was 120 on the large palms and 85 on the small palms. The largest bunches in the experiment were one with 172 strands on a large palm and one with 121 strands on a small one. The average sizes and yields of the bunches after thinning are shown in Table 1.

At the time of the last thinning operation the number of bunches was reduced so as to leave 12 on each of the large palms and 7 or 8 on each of the small ones. The fruit was harvested in five pickings from October 4 to December 2 except for one small picking on January 16 in Treatment A. The average production per palm is given in Table 2.

The California Date Growers' Association cooperated in the experiment. At the time of delivery, an inspector's grade record was obtained in accordance with the prevailing procedure in 1950. In addi-

Table 1. — Average Size and Yield Per Bunch in Barhee Thinning Experiments

	TREATMENT		
	A	B	C
Large palms:			
Number of stronds per bunch	81	83	39
Number of dates per strand	20-30	15-20	20-30
Yield per bunch — pounds* (calculated)	52.0	39.1	33.7
Small palms:			
Number of strands per bunch	56	56	34
Number af dates per strond	15-25	10-15	15-25
Yield per bunch — pounds* (colculated)	30.1	21.9	21.1

*Includes drop during horvest

Table 2. — Average Production of Fruit Per Palm in Barhee Thinning Experiments (Pounds)

	TREATMENT		
	A	B	C
Large palms:			
Picked	522	395	349
Field culls	103	75	56
Total	625	470	405
Small palms:			
Picked	191	155	145
Field culls	24	20	21
Totol	215	175	166

tion, the packing house kept a grade record of all the fruit. These grade data are given in Table 3.

Removal of only one-third of the total number of strands left the bunches on the older palms entirely too large. The Barhee variety has long and exceptionally strong fruit-stalks which will support large bunches, but with an average of as many as 81 strands per bunch, especially in Treatment A, it was difficult to handle the bunch in picking. On the small palms, the bunches were smaller and there was no trouble in handling. It was concluded that an upper limit of 50 to 60 strands is desirable. Thinning to the outer circle of strands, as in Treatment C, left about this number on very large bunches, but fewer than that on small bunches. Some of these smaller bunches were a little lighter than is desirable in a dry year.

Following a period of unusually hot weather in October a check of representative samples of ripe fruit showed more blistering, or separation of skin from flesh, in Treatment C than in either of the other two. The percentages of fruit which had one-half or more of the skin separated from the flesh were as follows: Treatment A—7.4; Treatment B—10.0; Treatment C—19.7. Weather, however, cannot be predicted and it is reasonably certain from past experience that these lighter bunches would have come through a period of prolonged damp weather in better condition than the heavier bunches, because of better aeration.

As was expected on the basis of past experience, a slight acceleration of ripening was caused by the heavier thinning treatments. Thus by November 2, the following percentages of the total crop had been picked: Treatment A—73.4; Treatment B—85.4; Treatment C—88.2.

The data given in Table 2 are calculated from individual palm records. They bear out the reputation of the Barhee variety for high yields. The field culls included a large proportion of fruit which fell from the bunches in picking but was too immature to be taken to the packing house. Much of this fruit could have been ripened in maturation rooms but we were not in a position to handle it.

In the spring of 1951, the number of inflorescences on the palms in Treatment A was slightly less than those on the palms in Treatments B and C. This makes it doubtful whether total yields during successive years can be maintained quite as high as those of Treatment A in 1950, but it is apparent that there will be no subsequent reduction in the yields of the palms in Treatment B and C.

Because the number of bunches per palm was arbitrarily limited, it is evident that differences in yield were due to differences in thinning. Yields equally as high as in Treatment A, however, could have been obtained in either Treatment B or C by retaining a larger number of bunches. Hence, we are justified in comparing the thinning treatments solely on the basis of grades.

Treatment A need not be considered for commercial practice because of the large proportion of extremely large and unmanageable bunches. Between Treatments B and C there was little difference as to either the inspector's grades or the packing house grades. It may be noted, however, that the packing house grade-out of fancy fruit was much lower than the inspector's in all three treatments. Part of this difference may have resulted from changes in the fruit during the interval of 10 days or 2 weeks between receipt and grading, when it was in storage at a temperature of about 35° F., but most of the difference is probably attributable to differences in standards and methods of grading.

The results of this experiment would not justify the additional expense of thinning the Barhee variety by removing individual fruits from the strands. It was estimated that this method would add not less than about one cent a pound to the cost of production. Although the experiment covers only one year and a

Table 3. — Percentages and Weights of Barhee Fruit from Different Thinning Treatments

TREATMENT	GRADED BY	FANCY	CHOICE	STANDARD	SUB-STANDARD	CULLS	SHRINKAGE	TOTAL
A (percent)	Inspector	23.9	39.0	33.7	1.6	1.8	.....	100
	Packing house	6.5	29.2	50.2	2.6	3.9	7.6	100
A (pounds)	Inspector	639.7	1043.8	902.0	42.8	48.2	(219.5)*	2896
	Packing house	189.0	845.5	1454.5	75.0	112.5	219.5	2896
B (percent)	Inspector	39.8	38.6	18.9	2.1	0.6	.....	100
	Packing house	9.0	33.1	45.0	1.6	3.8	7.5	100
B (pounds)	Inspector	828.6	803.7	393.5	43.7	12.5	(168)*	2250
	Packing house	203.0	744.0	1013.0	37.0	85.0	168	2250
C (percent)	Inspector	40.0	39.8	16.7	0.5	3.0	.....	100
	Packing house	9.0	28.9	50.1	1.3	4.0	6.7	100
C (pounds)	Inspector	746.0	742.3	311.5	9.3	55.9	(134)*	1999
	Packing house	179.0	578.0	1001.0	27.0	80.0	134	1999

*The inspectar's grade as determined fram small samples at time af delivery to the packing house would not, af caurse, take into account subsequent shrinkage. Hence far the purpose af camparison, the shrinkage that showed up later when the fruit was graded in the packing house was deducted fram the tatal weight delivered and the amounts af fruit in the different grades were calculated fram the percentages af the samples as reparted.

dry season, it suggests that under Coachella Valley conditions, a satisfactory procedure would be to cut back the tips of all strands at time of pollination enough to remove about one-fourth to one-third of the total number of flowers or fruits and later to remove from the center about 50 percent of the total number of strands, or more with large bunches so as not to retain more than 50 to 60 strands.

Medjool Experiments

Medjool is one of the later introductions of the U. S. Department of Agriculture. There will be some commercial production of fruit within the next few years. Medjool is classed as a soft date, but it is firmer than Barhee. One of its chief assets is the extra large size of the fruit, but the strands of the bunches are of only medium length and as a consequence there is often considerable crowding of fruit on the strands, which results in large variations in both size and shape of the fruit. As these variations are serious drawbacks in marketing, it is believed that the removal of fruit from the strands will be desirable in thinning this variety. Experiments were carried out in 1950 to obtain some indication of the results that may be expected from different degrees of thinning in this way.

Because of variability in size and condition of the Medjool palms at the U. S. Date Garden, the experiment was set up on a bunch basis. Bunches were selected in groups of 3, those in each group being of approximately the same age and size and on the same palm. On May 11, after pollination, one-half of the total number of strands were removed from the center of each bunch; then in each group of 3, 1 bunch was left without further thinning — Treatment 1, 1 bunch was thinned to 20 fruits per strand — Treatment 2, and 1 bunch was thinned to 10 fruits per strand — Treatment 3. There were 25 bunches in each treatment, but one fruitstalk in Treatment 1 broke early in the season, leaving 24. Three typical strands on each bunch were tagged and used for subsequent observations on drop and shrivel prior to the first picking. In picking and grading, all fruit in each treatment was handled as a unit. Size was not considered in grading, all of which was done at the U. S. Date Garden. Table 4 summarizes the data from this experiment and represents averages of all bunches in each treatment with the exception of the yield and grade data. The fruit was harvested in four pickings between August 30 and October 9 except for a few pounds on four very late bunches in Treatment 1.

Table 4. — Effect of Different Thinning Treatments on Medjool Fruit

	TREATMENT		
	A	B	C
Average number of dates per strand	35	20	10
Average number of strands per bunch	45	45	45
Average number of dates per bunch (calculated)	1575	900	450
Fruit drop*, May 11 to August 29 (percent)	20.7	22.4	21.5
Severe shrivel*, August 29 (percent)	8.4	2.0	7.0
Moderate shrivel*, August 29 (percent)	10.6	13.2	23.2
Percentage of crop picked by September 11	62.7	71.5	83.8
Yield per bunch (pounds, calculated)	32.8	24.2	14.2
Number of dates per pound (calculated)	33.6	25.6	23.4
Grade A (percent)	19.3	31.4	22.8
Grade B (percent)	62.3	54.6	66.4
Grade C (percent)	10.2	6.6	5.2
Culls (percent)	8.2	7.4	5.6

* Data from strand counts.

The size of the bunches prior to thinning varied from 60 to 120 strands. A reduction of 50 percent on each bunch left an average of 45 strands. Bunches with more than this average number of strands were difficult to handle in picking, especially if the fruits on the strands were not thinned. With the Medjool variety, therefore, it seems desirable to set an upper limit of approximately 45 strands to be retained after thinning.

Slightly more than 20 percent of the fruit dropped between thinning and the first picking; of this drop, approximately 80 percent occurred during the first two months after thinning. There were only slight, apparently insignificant, differences between treatments in amount of drop.

On August 29 a record was made of the amount of shrivel in the different treatments. Pronounced shrivel that would make the fruit either substandard or cull was classed as severe; wrinkling that would seriously reduce the fruit in weight was classed as moderate shrivel. The severe shrivel in Treatment 1 affected primarily the undersized fruit, most often on the ends of strands crowded with fruit, and probably it was the result of an inadequate supply of food material. In treatment 2 there was little severe shrivel. In Treatment 3 there was almost as much severe shrivel as in Treatment 1, but different causes were apparently involved. Because of the heavy thinning the fruit had obviously been subjected to excessive drying, but extra large size resulting from this heavy thinning may have made the fruit more susceptible to shrivel because of thinner, distended cell walls. Differences in amount of moderate shrivel, however, are probably directly correlated with differences in ventilation and exposure resulting from thinning and suggest that under conditions of high relative humidity somewhat heavier thinning than that of Treatment 2 might be justified.

The acceleration in ripening as a result of increase in severity of thinning is shown in the percentage of the crop harvested by September 11.

Size data were obtained from random samples, exclusive of culls, from each picking in each treatment. Since some of the drier dates were thus included, the weight of the top grades of fruit would be somewhat greater than the averages given in Table 4; but the data are believed to be a fair index of the increase in weight per fruit that can be expected in any grade from such thinning treatments. Thinning to 20 dates per strand, a reduction in number of fruit per strand of 43%, resulted in an increase of 31% in weight per date and 26% reduction in yield per bunch. Thinning to 10 dates per strand, a reduction in number of fruit per strand of 71%, resulted in an increase of 44% in weight per date and a reduction of 57% in yield per bunch.

In spite of the fact that size was not considered in grading, there was a definite increase in the percentage of first grade (A) fruit as a result of thinning to 20 fruits per strand. Since the large size of the Medjool date is one of its outstanding attributes and undoubtedly has sales appeal, there would appear to be justification for considering size in determining grade. If this had been done it would have increased the percentage difference in favor of Treatment 2. The removal of 50 percent of the strands and thinning to 20 fruits per strand resulted in bunches which would still be considered heavy and which were large enough to permit the maximum yield that the palm should be allowed to carry. On the other hand, thinning to 10 fruits per strand gave

very little more first-grade fruit than no fruit thinning on the strand, and there was such a pronounced reduction in yield per bunch that the maximum profitable yield per palm could not have been obtained with such bunches.

Summary

In experiments with the Barhee variety, the tips of the flower strands were cut back enough to remove about one-fourth of the fruit on each bunch. Later, one-third of the strands were removed from the center of each bunch. Further thinning by removing individual fruits from the strands did not prove superior to further thinning by removing entire strands.

With the Medjool variety, thinning by the removal of individual fruits from the strands appears to be desirable as a means of getting more uniform fruit of the extra large size characteristic of this date. In experiments covering one dry season in the Coachella Valley satisfactory results were obtained by thinning to 20 fruits per strand and leaving not more than about 45 strands per bunch.

An Irrigation and Fertilization Experiment with Deglet Noor Dates

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This report summarizes the results obtained in an irrigation and nitrogen fertilization experiment conducted with Deglet Noor dates from 1944 through 1950. The experiment had two main objectives. One was to determine whether subjecting the variety Deglet Noor to moderate water shortage during the ripening and harvesting period would affect yields or would materially reduce the amount of fruit spoilage that sometimes results from humid weather during this period and whether this practice would appreciably lower grades in dry seasons. The other objective was to determine the effect of nitrogen fertilization on growth of the trees and on yield and quality of the fruit.

This experiment was carried out at the U. S. Date Garden, Indio, California, on soil mapped as Coachella fine sand, though in a large part of the area there were silt and clay layers of varying thickness in the upper 10 or 12 feet of soil, which presumably contained most of the date roots. The trees were planted in 1935 and were 9 years old at the start of the experiment.

Procedure

The irrigation treatments, for convenience designated as "wet" and "dry," were as follows: (1) wet—an ample supply of water was maintained in the soil at all times so that leaf growth was not measurably affected by water shortage at any time; (2) dry—just before the fruit ripening period (Sept., Oct., Nov.) water was withheld until the rate of leaf growth was from 75 to 80 per cent of that of the trees in the wet treatment. The degree of water deficit required to keep the leaf growth rate fluctuating near 80 per cent of that of trees in the wet treatment was maintained by irrigating only a few furrows at a time. Usually water was applied in alternate middles on alternate irrigation dates. Except for the period just before and during ripening of the fruit the dry plots were given an ample supply of water. The drying-out treatment of the soil was usually started in mid-July and terminated in November. During this period the moisture content of a large part of the soil in the top 4 or 5 feet was reduced to or nearly to the wilting range.

The irrigation treatment described above was applied from 1945 through 1950. In 1944 the drying treatment of the soil was started in June and the soil was not wetted to field capacity throughout the root zone until December. The results of the irrigation treatments in 1944 have already been described.[2]

The nitrogen fertilization treatments consisted of unfertilized control (—N), and of the fertilized (+N) in which each tree received 6 pounds of nitrogen annually from 1944 through 1946, and 8 pounds of nitrogen annually from 1947 through 1950. The annual nitrogen applications were split into 2-pound lots at intervals of 4 or 3 months. Some ammonium sulfate was used, but most of the time ammonium nitrate was applied.

The irrigation plots were laid out in a garden consisting of 16 rows of 13 trees. The field was divided by pipe lines into 2 irrigation runs of nearly equal length. Each irrigation plot consisted of 4 record trees in a single row, and each plot was bordered on each of the 4 sides by at least one guard tree. The wet and dry plots alternated across the 2 irrigation runs. Each irrigation treatment was replicated 5 times.

Each irrigation plot was split to provide an unfertilized control plot and a nitrogen fertilized plot. The fertilized plots consisted of 2 record trees bordered by at least one guard tree. This provided 10 replications of the nitrogen fertilizer treatment.

An effort was made at the outset of the experiment to reduce error arising from variation in palm size among the different treatments. Record palms were selected in irrigation plots to obtain similar distribution of palm sizes (trunk heights) in each of the 4 treatment groups.

Records were regularly made of gain in height of trees, rate of leaf growth, production of inflorescences, yields and grades of fruit, and in some seasons of other things, such as moisture content of fruit and dry weight per fruit. Changes in soil moisture conditions in a few plots were measured each season by means of tensiometers or gypsum resistance blocks.

Results and Discussion

The influence of the irrigation and fertilization treatments on yield and on rate of gain in palm trunk height is shown in Table 1. The differences in yield and in gain in trunk height of palms in the wet and dry treatments were not greater during the last 4 years of the experiment than during the first 3 and were not significant during either period. In other words, the relatively short period during which the trees of the dry plots were subjected to water shortage during the fruit ripening period did not cause an appreciable reduction in the average annual growth in height of the trees or in the average yield per tree.

It appears that there was little or no response to nitrogen fertilization as measured by yield of fruit or growth in trunk height during the period 1944 through 1946, but that during the last 4 years of the experiment a significant difference both in yield of fruit and in trunk growth occurred. During this latter period the average yield and the average

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(2) Reuther, W. and C. L. Crawford. Date Growers' Inst. Rept. 22:11-15. 1945.

gain in trunk height of the unfertilized palms were only about 82 or 83 per cent of those of the fertilized palms.

Since each normal, uninjured inflorescence produced by a date palm will set fruit if the flowers are pollinated, the number of inflorescences produced each year provides an index of potential fruit production.

The average number of inflorescences per tree produced in each treatment and the mean values obtained in the periods 1943 through 1946 and 1947 through 1951 are shown in table 2. The mean number of inflorescences per tree produced in each of the treatments during the period 1943 through 1946 was nearly the same. There could not be, of course, any effect of treatment on

Table 1. The effects of irrigation and nitrogen fertilization on yield and trunk elongation of Deglet Noor date palms during a seven-year period.

TREATMENTS AND STATISTICAL INDICES	CROP YEARS								
	1944	1945[1]	1946	Mean '44-'46	1947	1948	1949	1950	Mean '47-'50
	MEAN YIELD PER TREE (POUNDS)								
Irrigation: Wet	250	105	248	201	175	248	170	208	200
Dry	217	103	233	184	161	215	148	216	185
F value				N.S.					N.S.
Fertilization: +N	228	114	238	193	179	260	172	231	210
—N	239	94	243	192	158	202	146	193	175
F value				N.S.					*
L.S.D. at .05									29
	MEAN ANNUAL GAIN IN TRUNK HEIGHT (FEET)								
Irrigation: Wet	3.0	2.3	1.8	2.35	1.8	1.2	1.4	1.7	1.52
Dry	2.8	2.0	1.7	2.16	1.8	0.8	1.4	1.7	1.42
F value				N.S.					N.S.
Fertilization: +N	2.9	2.2	1.8	2.28	1.9	1.2	1.6	1.7	1.62
—N	2.9	2.1	1.7	2.23	1.6	0.8	1.2	1.7	1.33
F value				N.S.					**
L.S.D. at .01									0.29

1. Roin domoge in 1945 coused spoilage ond loss of obout 60 per cent of the fruit.

Stotisticol symbols:

N.S.: Difference between the two meons is not significont.

* Difference between the two meons is significont by odds of more thon 19 to 1.

** Difference between the two meons is significont by odds of more thon 99 to 1.

L.S.D. = Leost difference for significonce between the two meons ot the probobility levels indicoted.

Table 2. The effects of irrigation and nitrogen fertilization on flower production of Deglet Noor date palms.

TREATMENTS AND STATISTICAL INDICES	CROP YEARS										
	1943[1]	1944[1]	1945	1946	Mean '43-'46	1947	1948	1949	1950	1951	Mean '47-'51
	MEAN NUMBER OF INFLORESCENCES PER TREE										
Irrigation: Wet	16.9	15.4	11.8	11.7	13.95	9.7	13.5	11.5	11.9	15.2	12.38
Dry	16.4	15.8	11.0	11.5	13.68	9.2	12.6	8.9	12.9	15.3	11.63
F value					N.S.						N.S.
Fertilization: +N	16.0	14.9	11.6	11.7	13.55	10.1	14.8	11.8	14.5	16.6	13.44
—N	17.3	16.3	11.2	11.5	14.08	8.8	11.3	8.6	10.2	14.0	10.57
F value					N.S.						**
L.S.D. at .01					——						1.48

1. Since flowers differentiote in the foll ond emerge the following spring, the production of inflorescences in 1943 ond 1944 wos not influenced by the treotments storted in 1944.

Stotistical symbols: See toble 1.

number of inflorescences produced in 1943 and 1944 since the flowers produced in those years were formed before the treatment started.

It seems apparent that in the period 1947 through 1951 there was little influence of the irrigation treatments on inflorescence production. There was, however, a marked effect of fertilization. In the unfertilized plots the mean inflorescence production from 1947 through 1951 fell well below that of the period 1943 through 1946, while in the fertilized plots the mean inflorescence production was about the same during both periods.

The data obtained on the vegetative growth of the palms in the various treatments are, in addition to serving in some instances as indicators of the effect of treatments, of some interest in themselves. From the average annual gains in trunk height listed in table 1, it appears that the period of rapid increase in height that is characteristic of young bearing palms was in this instance completed in the 11th year after planting, for after 1945 the average rate of gain in height was less than 2 feet a year and was fairly constant. These data indicate, unfortunately, that the increased yield resulting from nitrogen fertilization cannot be secured without accepting at the same time a small but significant increase in rate of gain in palm height.

It was found that during the period 1948 through 1950, when leaf elongation was measured without interruption, the annual average daily rate of elongation was consistently greater on the fertilized trees than on the unfertilized trees. The average rate of leaf growth of the fertilized trees was in 1948, 1949 and 1950, respectively, 3.1, 3.1, and 3.4 cm. a day; that of the unfertilized trees in the same years, respectively, 2.7, 2.8, and 3.2 cm. a day. During this period the most striking differences occurred in 1948, a heavy crop year (Table 3).

The average rate of leaf growth of the trees in the dry plots in September and October (about the middle of the dry period) was in 1948, 1949 and 1950, respectively, 3.4, 3.8 and 4.3 cm. a day; that of the trees in the wet plots during the same periods 4.3, 4.3, and 4.7 cm. a day.

It was observed in spring and early summer of 1947 before water shortage developed in the dry plots that the leaf growth rate of the trees in the dry plots was slightly higher than that of the trees in the wet plots. This trend continued and became more pronounced in the period 1948 through 1950. In 1950 the average rate of leaf elongation in the dry plots exceeded that in the wet plots until August, after which the rate was higher on the trees in the wet than in the dry plots (Table 3). It appears that by 1950 the increase in rate of leaf elongation on the trees in the dry plots during the spring and early summer, when they received an ample water supply, fully compensated for the lower rate during the period of water shortage. The average rate of leaf elongation during the year 1950 on the trees of the dry plots was 3.32 cm. a day and that of the trees on the wet plots was 3.27 cm. a day. The explanation for this apparent ability of the trees on the dry plots to make up some months later for time lost during the dry period is not known, but it may involve the utilization of reserves of food materials when there was ample water available for growth, or it may be simply a matter of less leaching of nitrogen below the root zone in the dry plots.

Subjecting the trees of the dry treatment to water shortage just before and during the ripening period caused slightly earlier ripening of the fruit, but in the following spring it caused a delay of several days to a week in the average date of pollination. The hastening of ripening tended to compensate for the delay in pollination so that usually the fruit from wet and dry treatments was harvested at about the same time.

The grades of fruit produced on trees under the different treatments were not consistently affected by the treatments. In certain seasons, it

Table 3. Average daily rate of leaf elongation (centimeters) by months on trees under different fertilization and irrigation treatments.

Year and Treatment	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1948												
+N	1.7	1.9	2.2	3.0	3.8	4.2	4.8	4.6	4.0	4.0	2.4	1.3
—N	1.3	1.3	1.8	2.4	3.3	3.6	4.1	4.3	3.9	3.6	2.0	0.9
1950												
Wet	0.8	1.5	2.4	3.1	3.3	4.0	4.5	4.8	4.8	4.5	3.2	2.3
Dry	0.9	1.7	2.6	3.2	3.5	4.2	4.8	4.8	4.5	4.2	3.1	2.2

Table 4. Percentages of natural and dry fruit and the different grades of fruit from the different treatments in the period 1948 through 1950.

	PICKED FRUIT						
Year and Treatment	Nat.[1] Percent	Dry[2] Percent	A&B[3] Percent	C Percent	D Percent	Culls Percent	Field Culls Percent*
1948							
Wet	32.4	67.6	64.5	29.5	3.6	2.4	9.5
Dry	29.2	70.8	63.1	31.3	3.8	1.9	8.3
+N	32.6	67.4	65.8	27.9	4.0	2.4	10.1
—N	28.9	71.1	61.4	33.5	3.4	1.7	7.4
1949							
Wet	15.5	84.5	41.8	50.4	5.8	2.1	1.4
Dry	15.8	84.2	39.7	52.2	6.0	2.1	2.7
+N	17.8	82.2	43.6	48.4	5.7	2.3	2.5
—N	12.8	87.2	37.4	54.6	6.2	1.8	1.4
1950							
Wet	8.6	91.4	36.8	47.4	13.8	2.0	5.3
Dry	9.9	90.1	43.1	41.9	12.9	2.1	4.5
+N	10.0	90.0	38.3	45.9	13.5	2.2	4.7
—N	8.3	91.7	42.1	43.0	13.2	1.8	5.1

1. Natural — fruit of such high moisture content as to require no hydration.
2. Dry — fruit that requires hydration.
3. Grades A, B, C, D, respectively, are synonymous with fancy, choice, standard, sub-standard.

* The percentage of field culls was calculated from total yield of picked plus dropped fruit.

appeared from observations during picking or grading of the fruit that there were, at least between certain plots of the different treatments, obvious differences in the character of the fruit. In 1947 the fruit from the fertilized trees was smaller (lower dry weight per fruit) than that from the unfertilized trees, and in 1949 the Dry +N plots had a high proportion of fruit that, when fully ripe, had an unattractive greenish color. It was evident in certain picks, usually the first of a season, that the percentage of dry fruit harvested from the dry plots was greater than from the wet plots, and at one time we thought that we had observed a greater amount of checking, blacknose, and darkening of fully ripe fruit from the plots under the Wet +N treatment. When, however, an average season's grades of the fruit from the different treatments were considered, these differences very largely disappeared (Table 4). The field culls were principally dropped fruits that were too dirty to run over the grader. Because of the small amount of A grade fruit, the A and B grades were combined.

The differences in percentages of natural and dry fruit or of A and B grade fruit were much greater in the different years than in the different treatments in the same year (Table 4). The large differences in percentages of naturals or of A and B grades between the fruit harvested in 1948, on the one hand, and in 1949 and 1950, on the other, resulted largely from differences in frequency of picking and in the proportion of fruit picked before the stem end was fully mature. In 1948 an attempt was made to pick the fruit as soon as it was sufficiently mature to harvest; but in 1949 an effort was made to avoid picking any fruit that was not fully mature, and in 1950 the picks were reduced to only 3 and greater care was exercised to reduce the harvest of fruit that was not fully softened and cured. The changes in harvesting practice, made to conform with commercial practice, apparently had much more effect on the percentages of naturals and of the various grades than did the fertilization or irrigation treatments.

These results would indicate that on soils similar to that used in this experiment the common practice of withholding irrigation water during a large part of the harvesting period to facilitate harvesting operations would not cause an appreciable decrease in the proportion of naturals or of the higher grades of fruit. Under some conditions, for example, those of high temperature and high humidity that sometimes occur early in the harvesting season, the practice of drying out the soil during the harvest period would probably favor a reduction in losses from fungus spoilage. In this experiment, however, the weather conditions were not such as to provide a satisfactory test of the effect of drying on fungus spoilage of the fruit. There was little weather favorable for fungus spoilage except in the extremely rainy and humid season of 1945 when damage was so severe as to obscure all minor effects. In this year there appeared to be a slight reduction in the percentage of culls in the picked fruit from the dry as compared to the wet plots, but since over one-half of the crop was lost, this was of little importance.

Summary and Conclusions

An irrigation and nitrogen fertilization experiment with Deglet Noor dates was carried out at Indio, California, from 1944 through 1950. The two irrigation treatments were (1) "wet"—the soil was kept well supplied with water; (2) "dry"—just before and during fruit ripening the soil moisture supply was reduced so that leaf elongation rate was reduced to about 80 percent of that of the wet treatments, but for the remainder of the year water supply was ample. Each irrigation plot was split to provide an unfertilized control, and a fertilized plot to which annual applications of nitrogen were made at a rate of 6 pounds the first 3 years and 8 pounds the last 4 years of the experiment. The drying treatment had little effect upon gain in height of the trees, and accelerated growth later in the year compensated for loss in leaf growth during the period of water shortage.

The number of inflorescences produced and the yield and quality of fruit were not significantly affected by the dry treatment. The dry treatment delayed the time of pollination slightly but hastened the time of fruit ripening slightly.

During the first 3 years of the experiment nitrogen fertilization had no apparent effect on growth or yield, but during the last 4 years of the experiment the fertilized trees had about 20 percent greater rate of trunk growth, production of inflorescences and yield of fruit than the unfertilized trees.

In one season the fertilized halves of the dry plots produced a high proportion of fruit that had an unattractive greenish color when ripe, but in general the quality of fruit from the fertilized plots was not appreciably different from that of the controls. The percentages of natural, dry, and A and B grades of fruit were affected to a greater extent by the frequency of picking than by the irrigation or fertilization treatments. The results of the drying treatment indicate that the common practice of reducing the amount of irrigation water applied during a large part of the harvesting season to facilitate harvesting operations would not, under conditions similar to those of this experiment, appreably increase the proportion of dry fruit harvested, or materially reduce yield.

Some Observations On the Costs of Producing Dates In 1950

Lewis J. Hutchinson, Farm Advisor, Riverside County

There have been a lot of questions the last few years about what it costs you to produce dates, so we thought it might be worthwhile to make a survey of some of the gardens to try to find out a little bit about what our changes are and what the influences of the years have been. If you recall, my colleague, H. B. Richardson reported some years ago on a date cost study of the six years 1934 through 1939. Some of the same gardens that were in his report are also in mine. We are not going to try in the time we have today to cover each one of the cooperator's gardens. This will be reported in brief in your bulletin and in its entirety in a cost study.

In that period of 1934 to 1939 there were a number of variables which had to be considered but much could be learned from the figures obtained, and we hope the same is true of ours this year. There were eight growers who cooperated this year with me, and I want to thank them here for their fine cooperation. I hope they will continue in this survey to get more needed information. This survey started as of the first of January, 1950, prior to the dethorning and pruning period for most gardens. From it we have obtained some rather interesting information.

In order to get an idea of what we have I would like to compare, if I may, and before I make compari-

sons, I would like to point out the danger in fixing averages. Bear in mind if you will please that these gardens were selected for solid plantings of fairly average Deglet Noor variety dates of about the same age throughout. There are various types of cultural practices running from basin non-cultured systems through furrow-irrigated systems and from ladder to service platform gardens. The figures shown are merely an average of gardens looked at. To know where you would fit into the picture, you have to bear in mind the variables that you have that are involved here. Don't fix figures too closely in mind except the most significant ones.

In Table 1 let's compare the yields. The figure for 1934-1939, as you well remember was influenced by the freeze year 1937-1938. One of the gardens in this study was very severely damaged; it produced only 2,500 pounds of fruit which brought the figure way down. The figure in 1950 was also influenced slightly from the frost we had in 1948-1949 but not to as great an extent. It is significant that yields have increased as they have since 1939. Richardson makes the remark in his publication that if we can reach the average acre tonnage of 8,000 pounds a good many of the high figures would be taken care of in average out of the cost of production. We now have an average figure higher than that and many gardens yield more than that year after year.

The cultural costs include labor actually put into production of the crop plus materials such as irrigation water, fertilizer, dusts, cover crop seeds — if used, which go into the production of that year's crop. Over twice the amount of money was spent in 1950 than the average of lower years. One of the reasons is that in the old study the main labor charge per hour was 30 cents. Most of us will agree that 75 cents is a fair figure for labor today. Another reason for the increase is all growers are using more materials at higher prices. Field power, still reported in horse units in the last study and now it is tractor units, is running much higher. Replacement costs are running much higher; this affects operations. Harvesting costs have gone up because of the increase in tonnage and the cost of man labor.

Cash overhead costs include general expenses such as general maintenance which is approximately 5 per cent of your labor. Other services go into the cultural costs — telephone, utilities, personal car — things that you feel are involved in the development and maturing of the crop. County taxes are included in cash overhead. They have increased about three times during the period between surveys; this is quite a substantial change. Cost for repairs of machinery, a cash overhead figure, have gone up. All those things have influenced the raising of the cash overhead figure.

Depreciation costs are figured on depreciation of your trees, buildings, concrete pipe used for irrigation systems, and equipment such as tillage, harvesting and sundry farm tools. Initial installation costs of a good many farm items have increased so that they influence the depreciation charges. Interest on your investment is greater. We have found too that most everyone will agree it takes between $1800 and $2000 to bring a date garden to eight years which in most cases is not full bearing but is commercial bearing.

The significance in these figures lies in the total yield, the total cost and the average cost per hundredweight. The yields have increased from 5,827 pounds to 11,644 pounds. The total costs give up $318.86 in 1934-1939 and $875.80 in 1950. The cost per pound was 5.47c during the old survey and 7.51c now.

The individual garden costs can vary greatly within one study showing the influence of weather conditions and the farmer's cultural practices.

Table 2 gives four samples of different garden's costs. These figures give an average of 6.74c per pound which is slightly better than the survey average. They were selected because of their wide range of yields. I would like to go across these figures and point out why some vary and why they do vary so greatly. It would be most ideal if we could change our operations and put all good things together under our conditions, but we try the best we can.

The first garden produced 14,348 pounds with a cost per hundredweight of $6.35. The reasons lie partially in a low pruning and brush removal cost. Their pruning is light each year and some Japanese farmers helped out by taking leaves for use with vegetables. Also the figure was kept low by low use of nitrogen fertilizers. No fertilizers were used during the 1950 season and very little dust — only a light sulfuring.

The next figures show a yield of only 7,864 pounds, but yet a cost of only $6.59 per hundredweight. This garden used a minimum of materials and labor during the year, and the crop was harvested by contract and not by the hour. This explains the low harvesting cost. This was a good arrangement for all because both the pickers and the grower made out well.

The third garden on Table 2 had the highest yield of any in the survey. A yield of 16,782 pounds should bring the per pound cost way down, but this wasn't the case. High pruning and brush disposal cost contributed. The fronds were mechanically chopped which in-

Table 1. — Let's Compare Per Acre Costs.

	1934-39	1950
Average Yield (paunds)	5827	11,644
Cultural Casts	140.61	373.14
Harvesting Casts	46.10	191.53
Cash Overhead Costs	27.49	132.72
Depreciatian Casts	45.26	100.45
Interest an Investment	59.40	77.96
Totol Casts	318.86	875.80
Averoge Cost Per Cwt	5.47	7.51

Table 2. — Typical Per Acre Cost in 1950.

Average Yield	14,348	7,864	16,782	8,972
Cultural	380.43	218.18	533.01	240.13
Harvesting	261.81	98.65	350.81	168.10
Cash Overhead	85.34	33.27	54.24	90.73
Depreciatian	103.41	92.12	102.29	77.71
Interest an Investment	80.03	76.59	72.13	67.77
TOTAL COST	911.02	518.81	1112.48	644.44
Averoge Cost Per Cwt	6.35	6.59	6.69	7.30

volves field and man power. High cost of dusts and other materials was also involved. However, the irrigation costs are nominal; this points out how much variation can be involved.

The fourth garden had only 8,972 pounds per acre which contributed greatly to the $7.30 per hundredweight cost. Many of the cultural costs were average, but the harvesting costs were slightly higher on a per pound basis. The shortage of crop was blamed on the freeze years that preceded the 1950 crop year. With an increased production this garden will be right in line.

Looking across the four gardens we see little variation in cash overhead costs except where they reflect equipment maintenance. Depreciation and interest are very similar so that the total cost in nearly all of the figures reflects the variations in cultural costs.

If we can draw conclusions here then it is obvious that by an increase in production on your part you can partially meet rising costs for materials, services rendered, etcetera. Improvement of cultural practices, where possible, will help you to increase the production. I don't know how many of you feel that the average production of 11,644 pounds per acre can be increased as an industry, but I feel that an increase in production will depend on the weather and changes in cultural practices.

For a more complete analysis of these observations I would suggest you obtain a copy of the complete report to be published by the Riverside County Agricultural Extension Service next month.

Mutual's Powers, Principles and Practices

Merton L. Corey, Marketing Counsel, California Date Mutual

World War II created market conditions which enriched the purses of growers but checked our progress in quality standards, impaired our marketing machinery and weakened our established concepts of economics and business.

Why trouble with quality and grade standards and the best of production practices if you could sell all you could grow anyway to a fabulous customer, "Uncle Sam," whose purse was bulging?

The consequences have been far reaching from this too much regard for the wealth of the moment, too little for the basic economic, production, marketing and sound moral and business standards and the independence which have been the justly proud boast of agriculture for generations.

The date growers of California shared in the excessive profits of this period, riding to the peak of the roller coaster in average price returns to the growers of .246 cents in 1944 and dropping with a sickening thud to the .047 cents of 1947.

Among the many who foresaw the drastic economic changes which would follow the end of the War was the legislature of the State of California which, in 1945, amended the Agricultural Code to provide the machinery whereby the fall could be cushioned and pointed the way clearly for the date growers to set up a sound marketing system.

The Code statement of purpose is a clear, concise outline of the most important principles in agricultural marketing economics. It is a repudiation of the narrow thinking that a grower's responsibility is solely that of production. Science and intelligent grower production practices have combined to make the California dates one of the finest examples of efficient production against great odds in the whole history of agriculture.

We are at last learning that production and marketing must be studied together. Where one ends and the other begins has no definite line. Both must have the common objective of supplying the consumer with quality production, so efficiently that the producer will receive fair profits.

Congress took notice of the fact that the U.S.D.A., the Land Grant Colleges and the experiment stations were paying too little attention to marketing. So it enacted the Research and Marketing Act in 1946 to encourage research and marketing projects through the cooperation of all official agencies and private distributors and retailers. Millions have been expended under this act and tens of millions more will be devoted to marketing to make up for time lost because of too much devotion to ivory tower theorizing and too little time given to practical tests of theories in the markets. I quote from Sec. 1190 of Chapter 4, of your code:

> "The purpose of this chapter is to promote, foster and encourage the intelligent and orderly marketing of agricultural products through cooperation; and to eliminate speculation and waste; and to make the distribution of agricultural products between producer and consumer as direct as can be efficiently done; and to stabilize the marketing of agricultural products."
>
> "The public interest demands that the farmer be encouraged to attain a superior and more direct system of marketing in the substitution of merchandising for the blind, unscientific and speculative selling of crops."

This law gives the growers power to do all the things listed in the Mutual Charter and grants them the following exemptions: I quote Section 1218.

> "Any association organized hereunder shall be deemed not to be a conspiracy nor a combination in restraint of trade nor an illegal monopoly; nor an attempt to lessen competition or to fix prices arbitrarily or to create a combination or pool in violation of any law of this State; and the marketing contracts and agreements between the association and its members and any agreements authorized in this chapter shall be considered not to be illegal nor in restraint of trade nor contrary to the provisions of any statute enacted against pooling or combinations."

California Date Mutual was chartered under this law and conforms to the Capper-Volstead Act which grants anti-trust exemptions in interstate shipments.

The disorderly markets and the ruinous price returns in the date industry can never be corrected unless the policies and practices authorized by this act are put into effect. The handlers are powerless to combine to improve these conditions. Only the growers can do so.

Stripped of all verbiage the Mutual principles and operating plans are simple and can be stated in substance in one short paragraph.

The growers who own the fruit and who are granted power by law which will enable them to stabilize the markets and fix prices will enter into contracts with handlers on such terms as they agree upon provided they do not conflict with Mutual's prices and terms under Mutual's contracts with handlers.

The handlers will select an advisory committee to assist Mutual in its operations.

Yes, it's as simple as that. If it seems radical it is only because you growers will at last use the powers you have so long neglected. And fair handlers will welcome this use of the powers they do not have, the lack of which accounts for most of the marketing faults which have proven so disastrous.

We should not waste much time talking about the mistakes of the industry. "Let by-gones be by-gones" in the judgment of persons and in appraising events is a pretty good rule for all, most of whom in one way or another contributed to past mistakes. Generally the handlers have tried to do an honest job. But now it should be clear to everybody that if you can't market an outstanding food product of which you have a monopoly, a product which combines the selling appeals of price, appearance, taste, dietary and nutritional values there is something seriously wrong with your marketing system. Handlers with the moral standards of angels and the wisdom of Solomon cannot rescue the date growers unless the growers themselves provide the vehicle the Federal and State governments have made available.

Mutual's charter powers are broad. Time will not permit me to read them. Most of you are members and have copies of the Articles and By-Laws. I suggest you read them again in the light of both present and anticipated problems. I am sure you will find them adequate.

I hope Mutual will not try to put many of its powers into effect until the need is clear and until the basic requirement for permanent success of this type of organization is achieved — that growers and handlers are working together in confidence and goodwill to achieve their common objectives. Finally, they will determine the scope and power of Mutual's program — provided always that it be kept clearly in mind that in this program, as in every other program set up under this law, the primary objective is to serve the interests of the growers. Handlers will realize that they can promote their own proper and honest interests by their serving the growers. They too would like to correct the present costly marketing practices.

There is much which a united industry can do; develop better quality standards, national advertising, promotion and merchandising, scientific research in the by-products fields, study all the multitude of questions in packaging, transportation, consumer preferences, and speak for a united industry before legislative and administrative agencies.

For the present season I believe that Mutual should be devoted principally to two general functions, some of those listed above being minors but tied in with these majors:

1. *Stabilization of the markets.*

This can be accomplished through the machinery and marketing skills of the handlers, operating under Mutual's powers.

2. *Establishing fair prices to the growers.*

I wish we could promise you whatever prices you want — that a resolution of Mutual, not markets and economics will determine prices. It isn't quite that simple. The prices should be fixed having in mind the marketing of *all* the crop at fair prices.

Such price fixing must be based upon thorough study of market, economic, price and competitive factors. If a mistake is made I hope it will be slightly on the low side, which can be readily corrected, whereas a mistake on the high side will be a serious one as the building of trade confidence is so important this first year.

The plan for a stabilization pool through an amendment to the marketing order will be a useful governor and assurance to the trade.

Equally commendable is the plan to provide for an advertising and promotional fund. Finally, the best plan in the world will not work well unless consumers want all you grow because they are satisfied with the quality and price and because you have stimulated their wants through skillful promotional plans.

Should this price be fixed at the grower level or at the wholesale level? Theoretically it is very alluring to control prices not only at the wholesale but at the retail level. Commodity groups would like to adopt many of the same control principles they condemn in government.

There are some compelling reasons why the price should be fixed at the grower level:

First, you can't police them at the wholesale level and the attempt to do so would seriously disturb what little trade organization you have. To do so efficiently would cost you many times more than your total budget.

Let those who think it could be done reflect upon the Black Markets of the war years. Despite penalties of imprisonment, be it said to the utter shame of those who did it at a time which called for the supreme sacrifice of so many young men, that hundreds of millions of dollars of farm products were sold in utter defiance of the enforcement authorities backed by all the power of the Federal Government.

Second, it is a sound American principle that the rewards should go to the most efficient, instead of adjusting our economy to the level of the inefficient.

If everybody pays the same price to the grower at point of delivery, more power to the handler who through skill and efficient management in his plant or in his marketing organization does the job thereafter at less cost, the savings to be kept as proper additional profit or returned to his grower patrons as good public relations in winning rival production.

No handler who pays the same price for his fruits as do the other handlers will continue the present consignment and cut throat competition practices.

In this connection I want to quote from a statement made by the President's council of economic advisers entitled, "The Economics of National Defense," Dec. 1950, sent me by a member of that Council of three, John D. Clark, who was a boyhood friend of mine and a classmate in the University of Nebraska Law School:

> "Policies must be fitted into some scheme of their relative importance, and deployed in some systematic relationship. Some policies are more important than others. Some policies cannot be effectively imposed until others are first adopted, although in the long run those which come later may be even more important than those which come earlier."

As applied to Mutual the point of all this is that here are broad powers which if you use skillfully you can move forward to new achievements from year to year. But I do hope you will master the basic foundation principles and practices through sincere, honest, intelligent cooperation of every branch of the industry before you determine you are going to conquer the world.

After all, you have been bedfast or reclining in a hammock under a palm tree for a good many years, so far as any real constructive thinking and planning in marketing is concerned. Your legs and arms may be strong from your physical labors but, frankly your past marketing record is not so impressive that even with a perfect tool like Mutual you are suddenly imbued with power to skillfully organize every branch and phase of America's complicated hodge-podge which we call markets.

Better suited to my limited understanding than the statement of John

Clark is a childhood ditty which fits this situation quite nicely:

"One thing at a time, and that done well, is a very good rule as many can tell."

The first immediate problem is to wisely handle the carry over of 7 million pounds.

If past marketing practices are not improved, much of it will remain as a price depressing influence with the opening of the 1951 markets.

Mutual does not have control of this crop but all its members have an interest in its marketing and many have an investment in the dates. With full cooperation of all handlers through Mutual it is believed that with this demonstrated unity we may be able to work out a plan with the trade which will make possible the orderly marketing of the remainder of the 1950 crop at fair prices, as well as clear the decks for the new crop.

Surpluses are hard to define. They are real or false. They are real when after complete study of all the economic, trade and marketing factors, it appears that under an orderly marketing program at fair prices, the entire crop cannot be moved.

Surpluses are false when because of disorderly marketing, consignment shipments, cut throat competition, without a skillful advertising and merchandising program, selling of the entire crop at fair prices is impossible. A "surplus" can be created any week or any month or for the entire season by unsound marketing practices.

Mutual proposes to wipe out false surpluses by coordination of the skills of all the factors in the industry. There has never been a surplus of dates and I see no threat of a surplus for some time to come, despite the acreage not yet in full bearing, if the industry will cooperate honorably and competently.

For example: Your crop of 1947 was only 20,320,000 pounds, yet you sold it for an average return to the growers of only .047 cents and this, too, at a time of high national income and unusual consumer buying power. The price indicated there was a surplus. From the grower standpoint there was because he received less than cost of production. But it was a false surplus, created not by economic conditions which were good, but by the almost complete failure of your marketing system to adjust supplies to demand and to eliminate the destructive practices which have almost ruined a business enjoying nature's generous bounty — a monopoly of a high class food which can be produced at costs which will give you strong competitive advantages.

In all of these matters Mutual will have broad powers. Whether in government or business you may have the finest system which the human mind can devise, but, if little, petty, designing, selfish men dominate its functions, it will fail.

As now constituted, Mutual's membership, officials and Board impress one with their ability, integrity, understanding and determination. I have unbounded faith in Mutual's future.

It is a cheering picture in this sordid and discouraging domestic and international confusion, to see this group of men and women, conscious of their own power, relying on self discipline, acting like traditional Americans courageously undertaking to solve their marketing problems, instead of joining the long line of mendicants before the government treasury.

Little designing men may weaken but never can defeat this effort if Mutual maintains its present spirit. Here and there, skulking in the underbrush, there may be a few snipers, when the season opens. They will not wish to destroy Mutual. Indeed they will wish for it limited strength and success, so they can chisel successfully a little below Mutual prices.

I doubt that any grower or handler neighbor of the many growers to whom Mutual's success is so important will deliberately weaken this organization through affirmative acts against us. But the grower who fails to act, the handler who does not cooperate will harm Mutual, whatever his motives.

All dates outside of Mutual add to the problem of convincing the trade of Mutual's power to stabilize the markets.

The machine has been built. It will prove crude at times, the parts will rattle, the gears will not mesh. These imperfections always appear when the perfect idea is construed by men with human faults. But as long as the spirit is right, the integrity unimpeachable, these men working together will perfect its mechanism to conform to experience.

There are many parts which must be fitted into the pattern, all with fair regard for their proper place — the handler's contract that they may fulfill their functions efficiently and with proper rewards, the soft date growers that their markets and prices may be stabilized both to assure fair returns and lay the foundation for the greater markets of the Deglets which follow.

Mutual will succeed, must succeed or you will go back to what you have had before. Is there any grower or handler so lacking in knowledge of these conditions, so insensitive to what this means to the growers and the general economy as to withhold his support of Mutual?

There is only one way his loyalty and cooperation can be evidenced— by entering into contracts with Mutual as a grower or a handler.

In conclusion let me express the hope that all agencies, public and private will assume their responsibilities to the fullest extent possible in a united effort to improve marketing. If, together, you succeed in this field as you have in production we will be assured a permanently prosperous future for the date industry.

A Panel Discussion on Date Standards

Farrell S. Stone, Assistant Supervisor, Southern District, Processed Products, Inspection Division, U. S. Dept. of Agriculture

This presentation will be purely a discussion of date standards, and I will try to answer any questions you have on the marketing order as regarding inspection. Your grading or standardization work is carried out in two phases. This past season a field run inspection was instigated on field run fruit as it reached the packing house. The final inspection or grading is done after the packer has completed his operations on the fruit and conformed to all U. S. Standards established by the Date Advisory Board under the date marketing order.

The U. S. Standards are established by the Federal Government and are fair standards in the sense that they are subject to revision from time to time. We always hope that when anybody has any ideas or disagreements with our standards that they will let us know so that we can keep the information on hand until we feel a revision of the standard is due; changes are necessary because

of changes in marketing practices or cultural conditions. If we have different ideas on standards and you feel that you have some ideal information helpful in a revision, let us have the information.

With these brief remarks, let us proceed with the questions.

Question: I can see that in a position such as yours it is difficult to get trained inspectors here year after year. Each year you have a changing group. Do you have a stronger nucleus now than you have had in the past?

Answer: This condition does exist, but I feel we have tried to meet it. Ours is a peculiar organization in that we have no money appropriated by Congress. We have to live on what we take in through inspection services. We therefore charge the Date Advisory Board for our services. I would like to have a trained staff here twelve months of the year. This is impossible from a financial standpoint. It is our hope that next year we will have a larger list of trained personnel than we have had here before.

Question: There are complaints from the buying public that U. S. grades mean nothing. How are you going to bring them to bear?

Answer: That is a tough question to answer. We have approximately 100 different U. S. standards covering lots of fruits and vegetables. In all those I can assure you the U. S. standard means a lot. This appears to be one commodity that has been badly disorganized. Near the end of last year, three packers made a definite effort to pack to an exact grade and it was beginning to show up in the trade's ability to get price differences between U. S. grades. This past season I would say that the general trend was to pack a combination grade which was part choice and part standard — the cheapest way to pack. I will not go into marketing practices because I am an inspector and not an economist.

Question: I question the U. S. standards established in conjunction with industry itself. How were they reached?

Answer: I believe Mr. Mitchell is one of the leading authorities on that, and I believe the Experiment Station helped us when we revised the current standards in 1949. Some people seem to think that a certain percentage of tonnage should be called fancy no matter how poor the crop is. I would change the name of it myself. Our idea is that our standards do not change with crop fluctuations. We feel that the fancy grade this year is a true fancy grade. It is very possible for you to have 10-15% in your fancy grade this year when last year you had 30% by the same line of reasoning and the year before that an even finer quality.

Question: Are all the standards written for Deglet Noor?

Answer: No, Sir; they are supposed to cover all varieties.

Question: Were the standards written on the basis of Deglet Noor variety?

Answer: Deglet Noor is the most generally grown variety. I believe that possibly more emphasis was placed on the Deglet. I have felt for quite some time that more attention should be paid to soft variety dates. I thing growers of soft dates want standards for these varieties. The same problem exists in citrus standards. Whereas Florida and California being citrus states think they should have a separate standard for their different varieties, the thought was that housewives would get the same thing everywhere.

Question: There is some criticism of the grade rating as the fruit is delivered to the packing house. The tendency in grading to grade relatively so that when a poor lot of fruit is brought in so much is graded out at "A," "B," and "C." So the tendency is not to produce as good fruit as it is possible to produce but to see how much fruit I can produce. Is there any consideration taken of that fact in setting up the training of these men to do that grading? Do you do anything to discourage relative grading?

Answer: I must agree that this condition does exist, but it is impossible to have our own objective tests. The Board of course is the one that established the field run standards under which everyone is getting the same treatment. Some make up for your lack of breakdown of all grades. In the Date Advisory there is no breakdown into standard, choice and fancy grades.

Statement: If we are going to set the wholesale price at the growers level, your inspection service has a vital job riding on the strength of the success or failure of the Mutual.

Reply: I'm getting a lot of gray hairs thinking about it myself. Since the Federal grades "A," "B," "C" and "D" covering dates have been established, the date industry and Advisory Board has never required compulsory labeling. It is our problem to determine fruit as standard or under. The culls, on the other hand, are an industry problem, and the Date Advisory Board problem is to properly put in force a date grade.

Statement: I don't think there is too much wrong with U. S. grades as such. There may be a little change that we may be able to make in our fancy. The U. S. choice is not far off if we grade to that as set up under U. S. standards. There has been a little difference in the way some inspectors interpret grades. It may be well to put on an educational campaign among the grade committee and inspectors next year and correct that. I think our biggest trouble has been this minimum grade standard that has been set up as a grade we have been adhering to. If any of you try to grade to these standards in U. S. choice for example, U. S. choice will have to be 80% free from defect yet we grade to the minimum grade standards. That is, 79% of the fruit can be choice in this minimum grade standard but still has to be called a standard grade. We should make choice a broad grade and put a point system on the standard allowance, and there could be no chiseling on grades. A committee is working on this need and is to make recommendations at the next meeting.

Reply: The Date Advisory Board has a committee with which I work to make changes for you they think necessary. I know of some problems which are coming up in certain cases where it is necessary to do some adjusting between now and the next board meeting.

The By-Products Pool and Its Place in the Industry

Maure Solt, Secretary-Manager, Date Advisory Board

This is not the first report to the date industry on the operation of a by-products pool. Reviewing the reports of past institutes we find that at least four such reports have been made in past years.

This report, however, is the first report on a compulsory pool under a Marketing Order for Dates.

The Order provides that the processor shall deliver to the pool at least ninety percent of the substand-

ard dates received from producers, as determined by the grade determination inspection at time of delivery.

Early in the 1950-51 marketing season the Date Advisory Board adopted some general policies relative to the operation of the pool.

1. Operating expenses shall be kept to a minimum.

2. Processors shall have an option on the dates contributed by them but shall exercise that option upon notification.

3. Funds shall be distributed to the growers as rapidly as possible.

We established an accounting system which involved a daily statement of account for each processor. This statement is not unlike a bank statement in that it indicates deposits and withdrawals.

As the grade determination certificates reach our office each day, our staff determines the poundage of substandard dates in the delivery covered by the certificate. Ninety percent of that poundage is charged to the processor's account.

Each thirty days the processor is requested to deliver that poundage to the pool or exercise his option and purchase the dates at the price established by the Board.

On September 27, 1950 the Board established a price of six cents per pound on all dates sold from the pool.

Our first statement of account was sent out to the processors on October 10, 1950 and the response from the processors was most gratifying. Most of the processors immediately exercised their options and remitted for the poundage charged at six cents per pound. Those not purchasing were ready to deliver to the pool.

In order to keep storage charges to a minimum we prevailed upon the processors who had fruit to contribute to the pool to hold the fruit in the name of the Board until the fruit could be marketed. The cooperation of all of the processors in this arrangement was excellent and many hundreds of dollars in storage costs were saved which will revert to the growers.

By mid-October we had reached the point where we must start our sales campaign among food processors, confectioners, bakeries and other possible outlets for by-products dates. But, first, we had to develop a sales contract which would permit the sale to manufacturers of these by-product dates in whole form, yet would absolutely guarantee ultimate conversion. After many drafts and redrafts we prepared a contract which has since proved to be "airtight."

The contract provides that:

1. The buyer expressly represents that he is purchasing the dates only for the purpose of using them for conversion into date by-products.

2. The buyer agrees to hold these dates separate and apart from any other dates held by him and agrees upon request to notify the Board of the place at which these dates will be held and stored.

3. The buyer agrees to perform conversion, at his expense, under the supervision of the United States Department of Agriculture, Processed Products Inspection Service.

4. The goods are at the risk of the buyer from the time the Board delivers them to a carrier for transportation to the buyer or to any third person the buyer may designate.

5. The buyer agrees that the Board shall have access to his plant and buildings, or to any plant or building where such dates are stored or used, for the purpose of verifying the manner of their storage or use.

The Contract also provides for the usual examination of books and records and other clauses necessary under the Marketing Order.

Upon making sales contracts it soon became apparent that manufacturers of food products who have not purchased dates previously due to the scattered supply and variable prices, were now interested upon learning of a centralized supply and stable price. After four contracts had been made the supply from the September accounting was sold and 10,000 pounds additional.

By October 20 we had collected approximately $30,000.00 and started distribution of the funds to the growers. The Board authorized a progress payment of four cents per pound and practically all of the growers have received that amount to date. Additional funds are at hand now but for the sake of economy we will make only two payments, the second will be the final one and will be made in the near future.

On January 8 we found that we had more orders for substandard dates than our supply at the time would fill. We recommended to the Board that the price be advanced to eight cents per pound. The Board took such action and since that date all dates sold from the pool were sold at that price.

Through April 20th, 2,769,319 pounds of dates have been certificated as substandard dates. That represents 9.87 percent of the crop. During the 1949-50 season we certificated 1,527,574 pounds or 5.85 percent of the crop.

We have distributed to growers $91,413.88 to date and will have an additional amount of approximately $55,000.00 for later distribution. Expenses incurred in the operation of the pool to date total $447.60.

The unsold poundage in the pool today is 272,000 pounds. This poundage will be sold in the next fifteen days.

We have learned a number of important facts in the operation of the pool this past year.

1. Providing a centralized supply is available at a stable price, good outlets are at hand for all of our by-products dates.

2. We must eliminate the culls from the by-products fruit.

3. We must take into the pool a uniform package, preferably a lidded, paper-lined, 30-pound net lug.

As a result of our experience with the pool and our contacts with food processors this season, we recently made a six point recommendation to the Board, as follows:

1. The demand for dates for manufacturing purposes now exceeds the supply.

2. The operation of the compulsory pool has brought the substandard dates out into the open. This practice must be encouraged by obtaining the highest possible price for these dates.

3. We are developing new outlets for the future and a strengthening price picture is one of our best sales talks.

4. The Grade Committee should take immediate steps to adjust the Standard grade in order to eliminate the lower portion of dates presently going into the grade. As the price structure of by-products dates moves upward, the total price structure on all grades must do likewise. We believe that this can more easily be accomplished by the elimination from the Standard grade of some of the "border-line" dates. We should aim to encourage the production of higher grade dates and we believe that this move would accomplish that purpose.

5. The Grade Committee should take the necessary steps to adjust the substandard grade toward the elimination of dates from this grade which are culls and should be so classified. As we develop additional outlets for this grade we must be sure that the grade is of edible quality and will not require resorting.

6. A pool for cull dates should be established. We are not receiving full value for cull dates due to the scattered supply. Specialty food manufacturers particularly would buy large quantities from a single source of supply at a price comparable to that paid for other sweetening agents.

Date Growers' Institute — 1951 Membership

Adams, Burnham — Playa Del Rey
Arkell Date Gardens — India

Borter, Marjorie Clum — Sierra Madre
Blackburn, R. W. — Thermal
Bliss, Donald E. — Riverside
Breyer, Alberto — Buenos Aires, Argentina
Brown, T. R. — Thermal
Burnett, J. Burton — Thermal

California Date Growers — Indio
Capper, Melvin — Palm Springs
Carlson, Ted — Indio
Carreon, Dr. R. J. Jr. — Indio
Cavanagh, H. L. — Indio
Chernus, John — Indio
Citrus Experiment Station — Riverside
Clancy, Leslie M. — Sonta Monica
Coachella Ranches — Riverside
Codekas Bros. — Thermal
Codekas Estate, E. J. — Thermal
Collins, A. E. — Yuma, Arizona
Conroy, Mrs. Jessie B. — Indio
Cook, W. W. — Palm Desert
Corey, Merton L. — New York, N. Y.
Cosgrove, Robert S. — Indio
Crommelin, Marjorie B. — Palm Springs
Cross, B. L. — Indio
Cruess, W. V. — Berkeley
Currlin, Ed. — Thermal

Darley, Ellis F. — Riverside
Darnell, W. G. — Brawley
Date Palm — Indio
Da Vall, Robert J. — Cathedral City
Davis, E. Fred — Los Angeles
Desert Garden Date Shop — Palm Springs
DeVillier Date Garden — Phoenix, Arizona
Dillman, R. S. — Yumo, Arizona
Dove, Moshe — Israel
Downing, A. P. — Brewton, Alabama
Dunlap Ranches — Thermal

Echols Ranch — Thermal
Embleton, Tom W. — Riverside
Enochs, T. M. Jr. — Coachella
Ensign Ranch — Julian

Farrar, E. Keith — Indio
Farrer, S. M. — Altadena
Follansbee, M. M. — Los Angeles
Furr, J. R. — Indio

George, Frances M. — Indio
Gerke, Sunny — Los Angeles
Graham, John E. — Thermal
Granda, Heloisa G. — Sao Paula, Brazil

Hagberg Estote, A. E. — Yuma, Arizona
Hassler, Korl — Los Angeles
Hayes, Dr. Kenneth S. — Indio
Hayes, Lewis S. — India
Heiny Nursery — Brawley
Hi-Acres Ranch, Inc. — Thermal
Higary, M. A. Gawad — Orman, Egypt
Hilgeman, Robert — Tempe, Arizona
Hill Bros. — New York, N. Y.
Hodgson, R. W. — Los Angeles
Homola, Tony — Calexico
Hubble, B. M. — Monrovia
Hunt, Clinton S. — Lo Quinta
Hutchinson, Lewis J. — Riverside

Jarvis, E. C. — Thermal
Jarvis & Gebhardt — Thermal
Jenkins, W. G. — Thermal
Johnson, Ronald L. — Thermal

Keck, Albert P. — Indio
Kiener Estate, Harry — Los Angeles
Kitagawa, Joe A. — Thermal
Kral, Louis — Calexico

Laflin, Ben Jr. — Thermal
Laflin, Ben Sr. — Thermal
Leach, George — Thermal
LeBaron, Edgar M. — Mesa, Arizona
Lichty, Kenneth — Indio
Lindgren, David — Riverside
Lundberg-Bigler Ranch — Indio

Mackenzie, J. F. — Los Angeles
Macpherson, D. F. — Indio
Marcos, Frank M. — Thermal
Markley, Walter C. — Palm Desert
McBean, Kelley — Indio
Mitchell, D. H. — Indio
Mock, D. C. — Redlands
Moog, Emanuel — Laguna

Nash, F. C. — Altadena
Newcomb, Albert — Thermal
Nittinger, E. P. — Santa Monica
Nixon, Roy — Indio
Norris, H. J. Jaleto R. — Los Angeles
North Ontario Dried Fruit Co. — Los Angeles

Ormerod, George A. — Phoenix, Arizona

Paradate Packing Co. — Thermal
Pinyan, R. A. — Indio

Rancho Palm Springs — Indio
Reuther, Walter — Orlando, Florida
Richardson, H. B. — Davis
Richardson, Walter L. — Porterville
Richert, Hubert C. — Indio
Russel, Robbins — Redlands
Rygg, G. L. — Pomona

Scholl, C. A. — Death Valley
Schroeder, C. A. — Los Angeles
Schwab, Ernest M. — Thermol
Schwabacher, A. E. — San Froncisco
Sharples, George — Tempe, Arizona
Shields Date Gardens — Indio
Smead, Paul — Thermal
Sniffs Date Gardens — Indio
Solt, Maure — Indio
Sphinx Date Garden — Phoenix, Arizona
Stocks, Charlotte — Thermal
Swingle, Leonhardt — Indio
Swingle, W. T. — Washington, D.C.

Turk, Howard — Coachella

Venus Foods — Los Angeles
Vincent, Lloyd E. — Riverside

Walker, D. C. — San Gobriel
Walker, Dr. Joseph — Hollywood
Walker, T. W. — Indio
Wallace, Earl S. — Thermal
Webb, Leno Cooper — Thermal
Webb, Robert W. Jr. — Palm Desert
Willebrandt, Mabel Walker — Los Angeles
Wilson, Gwynn — Arcadia
Winsor, Mulford — Phoenix, Arizona
Wise, J. F. — Mecca
Wood, James C. — Phoenix, Arizona
Woodbury, George J. — Indio
Wurts, T. M. — Indio

Yost, Leland — Thermal
Yowell, Hillman — Indio

Zalay, Z. E. — Indio